FLIGHT
and
AIRCRAFT ENGINEER

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The Outlook

Round the World Non-stop

THE earth has been girdled in non-stop flight at last, and March 2nd, 1949, will be added to other famous dates in history as the day on which this achievement was first accomplished.

Our American friends in general, and the United States Air Force in particular, are to be warmly congratulated on their enterprise in securing this significant "first." At the same time we in Great Britain can derive a certain degree of satisfaction from the fact that the equipment in the Boeing B-50 and its B-29 tankers was of British design and manufacture. It must have been a proud moment for Sir Alan Cobham and Flight Refuelling, Ltd., when news was received that the test had proved a success.

Sir Alan has been erroneously reported as being the "inventor" of refuelling in flight. The paper read by Mr. Latimer-Needham before the Society of Automotive Engineers in Detroit on January 13th (summarized in *Flight* of January 27th) showed that Sir Alan saw refuelling done in America as a stunt; but it is to his everlasting credit that he realized the possibilities of more serious application, and that he and his associates persevered in face of scant encouragement, if not downright opposition, with the development of the system with which his name is now so closely associated.

What is to the credit of no one is the fact that in spite of successful and convincing demonstrations during extensive trials over the South and North Atlantic, B.O.A.C. and the Ministry of Civil Aviation have not yet been able to make up their minds sufficiently to give a decision one way or the other concerning its adoption, in spite of the fact that the North Atlantic trials finished many months ago.

The U.S. Air Force does not shilly-shally like that. America is very long-range-minded, and here seemed to be a system whereby any spot on the earth's surface could be reached by a bomber. It was worth a trial, and now the world has seen one result. Others will follow.

Before the war ended, Flight Refuelling, Ltd., had a contract for converting Lancaster bombers for flight refuelling. The war ended, and the contract was cancelled. How stupid that action was can now be seen, when it has become obvious that unless it is to be equipped with American bombers, R.A.F. Bomber Command will have to rely on Lancasters and Lincolns. Refuelling in flight would not have increased their speed, but it would have added to either their range or to their bomb load.

In his paper Mr. Latimer-Needham outlined how refuelling in the air could be used to best advantage. It behoves our authorities to study that paper carefully. In the case of jet-propelled aircraft the need may be even greater, and although the speeds involved will raise difficulties, we may expect the U.S. Air Force not to rest content with the present achievement, great as it is. Our own authorities will probably be too timid to do anything.

Dear, Doubtful Defence

MORE than six hours of talking in the House of Commons last Thursday failed to elicit from the Government any concrete information concerning what value the country is getting for the staggering expenditure on defence (£760 million). Moreover, there were few indications that the Government has any properly co-ordinated defence policy. The excuse was made that such information could not be given without incurring risks of potential enemies deriving considerable benefits from any disclosures made to Parliament.

Mr. Oliver Stanley, for the Opposition, moved that "This House, while willing to call upon the Nation for whatever sacrifice of money or personal service is shown to be necessary to secure the national safety, cannot approve a statement which reveals so little result in

effective fighting power in return for the very large resources of manpower and money already voted by Parliament."

Mr. Alexander, in asking the House to approve the *Statement on Defence,* spoke for more than an hour without really enlightening the House. Mr. Stanley complained that he knew very little more after listening to Mr. Alexander's speech than he did after he had read the White Paper, just as he knew practically nothing more after he had read the White Paper than he did before he ever looked at it.

After reading Mr. Alexander's speech in *Hansard,* we were irresistibly reminded of a cartoon of Mr. Asquith which appeared in, we think, *London Opinion* many years ago. The caption read: "I cannot understand how anything I may or may not have said could or could not have given anyone any impression whatever."

The secretiveness with which the Government surrounds its defence plans came in for much criticism. As Mr. Stanley put it, "What begins as a defence against a potential enemy may quite well end as a defence against a potential critic." Much the same feeling was expressed by several speakers in the Lords' debate on the strength of the R.A.F. earlier in the week. It was first voiced by Lord Templewood, a former Air Minister. "The father of the R.A.F.," Viscount Trenchard, pleaded with the Government to publish the Air Force List again. Viscount Portal of Hungerford, a former Chief of the Air Staff, thought that, on balance, secrecy will lose us much more than it will gain us. And several Noble Lords stressed the difficulty of manning a Service of which no information is disclosed.

Lord Henderson, in the House of Lords, and the Prime Minister in the Commons, reiterated the Government's view that little information should be disclosed for fear of helping a potential enemy. The answer is, of course, that only a Power whose defences are weak need fear disclosure. The United States is strong, does not mind disclosing a great deal of information concerning defences and the reasons for her requirements. Voluntary recruiting is excellent. We hide everything, and our recruiting is disappointing. The moral is obvious.

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Curiouser and Curiouser

NO more satisfactory than the defence debates was that in the Commons, when the subject was civil aviation, about which Hon. Members talked interminably on March 1st.

Two of the concrete facts which caused surprise were the announcement that the Tudor IV is to be used for freight-carrying only, and that Mr. d'Erlanger is to be replaced by Lord Douglas.

With reference to the former, it does not appear to have occurred to any M.P.s that the two Tudors which caused the relegation were lost in an area where several American aircraft have disappeared, a fact which might indicate that the mysterious cause may have nothing to do with the type of aircraft.

As for the change in B.E.A. chairmanship, this was not unnaturally ascribed to political jobbery. Just why a man with long practical experience should be replaced by one who, however excellent his Service record, has little transport background, was not satisfactorily explained. At present it is not certain that Mr. Wood, the chief executive, will return, and one wonders what will be the position of Mr. Peter Masefield, who was assistant to the retired chairman.

SEE THE CONQUERING HERO—: The first aircraft to fly non-stop round the world—a Boeing B-50 bomber—is seen touching down at Carswell Air Force Base after its historic 94-hour voyage, made possible by British Flight Refuelling equipment and technique. An account of the flight appears on page 295.

"Flight" photograph.

The pronounced difference between aircraft heading and direction of take-off can be seen clearly from the heading of the port wheel, which is still on the ground.

Self-aligning Autocrat In the Air

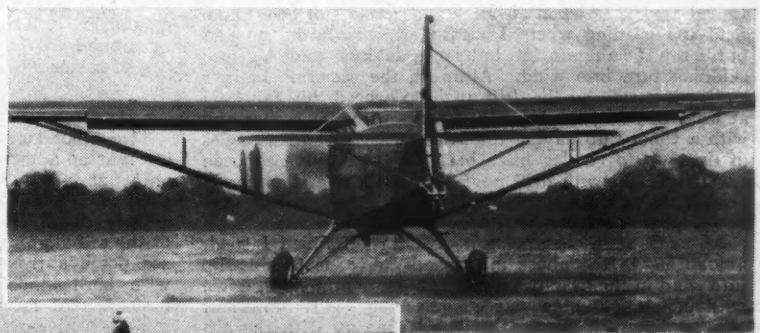
Goodyer Cross-wind Undercarriage Available for Auster Owners : Experience with the Prototype

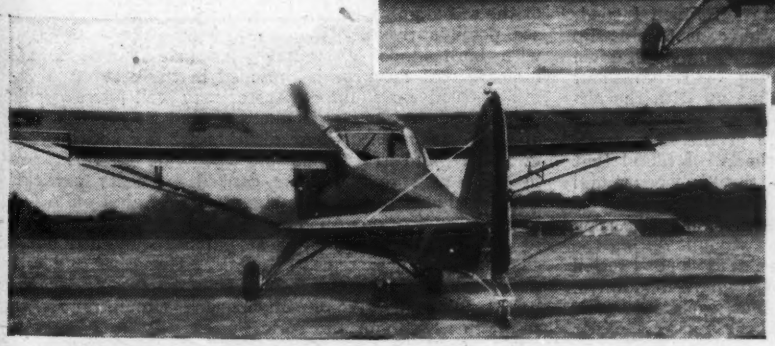
By WING CDR. MAURICE A. SMITH, D.F.C.

ALTHOUGH the personal "In the Air" impressions below arise from a flight in a specially-equipped Auster Autocrat, they are in truth concerned with the aircraft when on the ground. Moreover, the operation of the Goodyear self-aligning undercarriage produces motions and reactions so unlike those normally experienced when taking off, landing or taxying that a skater would be as well qualified to describe them as a pilot, who runs the risk of being biased in his observations. In general terms, the automatic castering of the main wheels can be said to allow one to forget many of the most important first principles of landing and taking off.

Denham airfield, Bucks, was the scene of the flights, and the weather on the occasion was anything but suitable for operation of a light aircraft. Of sunshine there was plenty, but the cold wind was blowing at gale force with considerable gusts near the ground and severe bumps a few hundred feet up.

Quite a lot has been written about self-aligning undercarriages, and there is nothing very new about the idea. However, it is the first time in this country that a standard light aircraft—Britain's leading utility design, in fact—has been so equipped. The Goodyear Duck, a similarly equipped and intriguing little amphibian described in *Flight* of March 18th last year, demonstrated well the potentialities of its maker's cross-wind landing device, but could not bring the fact home to British private and club pilots in the same way as will the Autocrat with





"Flight" photographs.

(Above) This take-off was commenced some thirty degrees out of wind to starboard and, the tail having lifted, the pilot is letting the aircraft turn into wind while the wheels continue along the original path.

(Left) A landing made under similar circumstances to the take-off above. The aircraft is heading approximately into wind but the landing path conforms with the approach, which was thirty degrees starboard of wind.

Self-aligning Autocrat . . . . .

which they are so familiar. It may be news to many private owners that the Goodyear landing gear, together with the single-disc hydraulic brakes associated with it, can now be supplied by Auster Aircraft for £130 ex-works. A small number of sets of components are being made up by the Goodyear Company, but should there be a large demand more may be made available, possibly at a lower cost.

The purpose of the self-aligning wheels is to permit the aircraft to be operated from single landing strips, more or less regardless of wind direction. In addition, it virtually eliminates the dangers of ground looping following out-of-wind landings, and would allow an inexperienced pilot to operate a light aircraft safely in winds which would otherwise keep him on the ground.

Perhaps the best way to explain the qualities of the Goodyear landing gear is to describe experiences with the Auster. For a start I tried an out-of-wind take-off. Without any of the normal care about direction and about one wing being down as the aircraft comes off, the throttle can be opened, direction controlled with the separate heel brakes (which are smooth and effective) and the Autocrat left to do the rest. As the tail comes up the aircraft tends to weathercock into wind, but the direction of run remains as before and the view "ahead" may even be through the side window. The impression to the pilot is one of smooth sideslipping, and there is no feeling of danger or instability. In the absence of side-loads on the legs, the tendency to tip over in a strong cross-wind is also absent; in its place there is a sideways component of forward motion and the wheels align themselves appropriately. For this reason also the aircraft may be kept on an out-of-wind heading during take-off without fear of digging-in the down-wind wing-tip. To the pupil experiencing difficulty in understanding the triangle of velocities in elementary navigation, out-of-wind taxying on the Goodyear Autocrat would present a good object lesson.

Up to 40 deg of Drift

For landing, the castering wheels may be used (or in one sense abused) without fear of damage, and their angular movement of 25 deg each side of central sets no out-of-wind limit. For a trial of drift landing I simply ignored the windsock and approached on a predetermined path some 30 deg to port of the strong wind. I ignored the obvious drift and touched down as usual. Motion relative to the ground on the landing run continued almost as when airborne and a touch of heel brake held the heading where I wanted it. Towards the end of the run the aircraft, left to its own devices, made a gentle skidding turn into wind. Although the castering limit is 25 deg it is safe for the drift angle to exceed this figure by at least 10 deg. During experiments with the Auster and with a Piper Cub having the same castering limits, angles of drift up to 40 deg have been tried out. It has been calculated that with drift angles up to 45 deg, the energy tending to produce a ground loop is reduced to less than 10 per cent of what it would be with fixed wheels.

An even more convincing demonstration which I tried, amounting to the abuse mentioned above, is to side-slip into wind in the usual way and to hold off and touch down without straightening out or checking drift. Without abnormal impact shock, the wheels line up with the aircraft direction and one side-slips or sidles to a standstill.

A final taxying trial convinced me of the safe, fault-covering qualities of the castering wheels. I found that with take-off flap and about one-third throttle I could taxi medium-fast with tail up, and kick-on rudder from side to side, so producing large swish-tail movements. The path of the Autocrat remained more or less straight during the performance. There were no appreciable side-loads exerted on the legs nor was there any tendency to tip over sideways. Such antics with a conventional undercarriage would most probably have ended in disaster for the Auster. Other heavier types of aircraft would almost certainly have lost a leg.

"Flight" photograph.

The single-disc hydraulic brake can just be seen on the otherwise standard-looking Goodyear wheel. S/L. R. L. Porteous, chief test pilot of Austers, is at the controls of the self-aligning machine. Its Cirrus Minor engine is equipped with a Fairey metal airscrew.

Experiments with Goodyear's cross-wind landing gear are proceeding in America; small tail-down and tricycle designs, and much larger machines, have been equipped and tested with success. Examples of aircraft so fitted are the Piper Cub, Stinson, Aeronca Chum (tricycle) and DC-3.

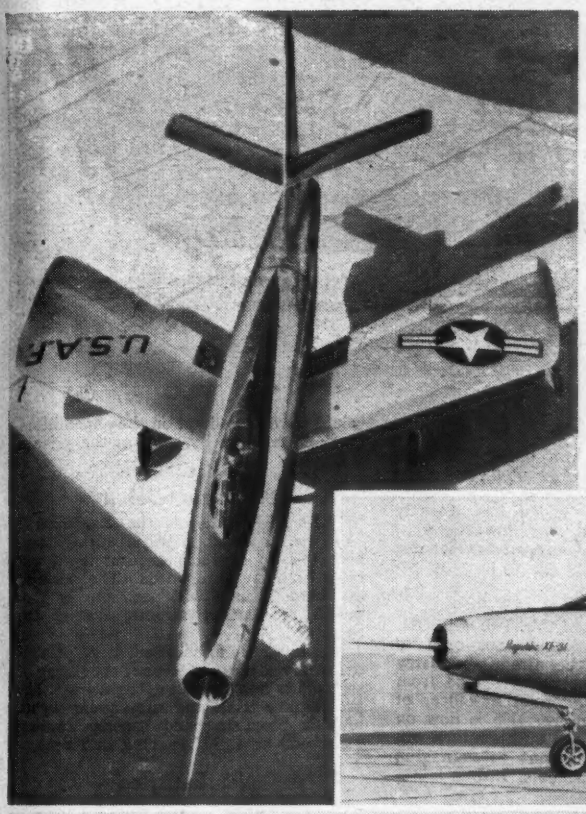
In the earlier installations the wheels toed in or out when the aircraft was backed up. This is very inconvenient when moving around tarmac or hangars and, therefore, a notch system has been devised which keeps the wheels parallel when the forces on them are small. There is, state the makers, no danger of the wheels now being fitted ever failing to caster when making a drift landing. The figure given by Mr. O. W. Loudenslager, manager of Goodyear research and development in America, is a resisting torque provided by the notches equal to about half the product of the side force times the theoretical caster length. The notch system was adopted after the use of pilot-controlled locks had been considered and rejected on the grounds of risk and complication. In the case of the experimental DC-3, locking pins inserted and removed manually by ground crew are, in fact, used. In this installation 15 deg of caster on either side of the centre is permitted.

Tyre Effects

Two other facts established by experiment, it is stated, are that no additional trouble is experienced when landing on a flat tyre and, secondly, that tyre wear is at least as good as, if not better than, with fixed wheels.

Only detail differences indicate visually the presence of the self-aligning wheels on an Auster, and one can foresee possible trouble for a club which operates Austers with both kinds of landing gear unless some suitable indication of the type is provided in the cockpit.

The Goodyear-equipped Auster may well prove popular in this country, but it is likely to find its greatest value abroad, in countries where airfields are few and mediocre in quality, and frequent use must be made of strips cleared in scrub and jungle. One can also see its particular qualities being of considerable practical value on A.O.P. and communications Austers which are expected to operate in service from strips or clear patches scratched out at short notice, in extremes of wind and weather and often many miles from repair bases. Slight damage due to a bad landing or take-off under such circumstances can result in a write-off.

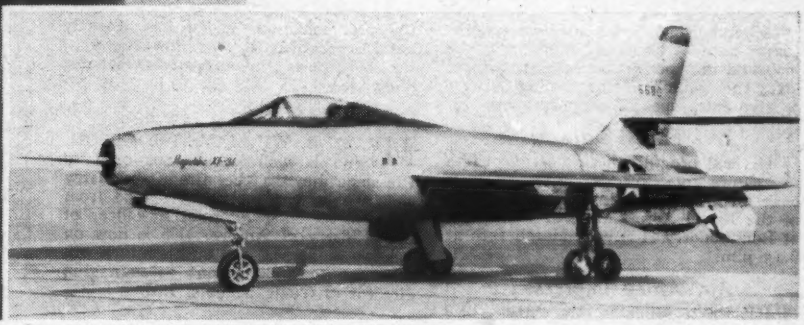


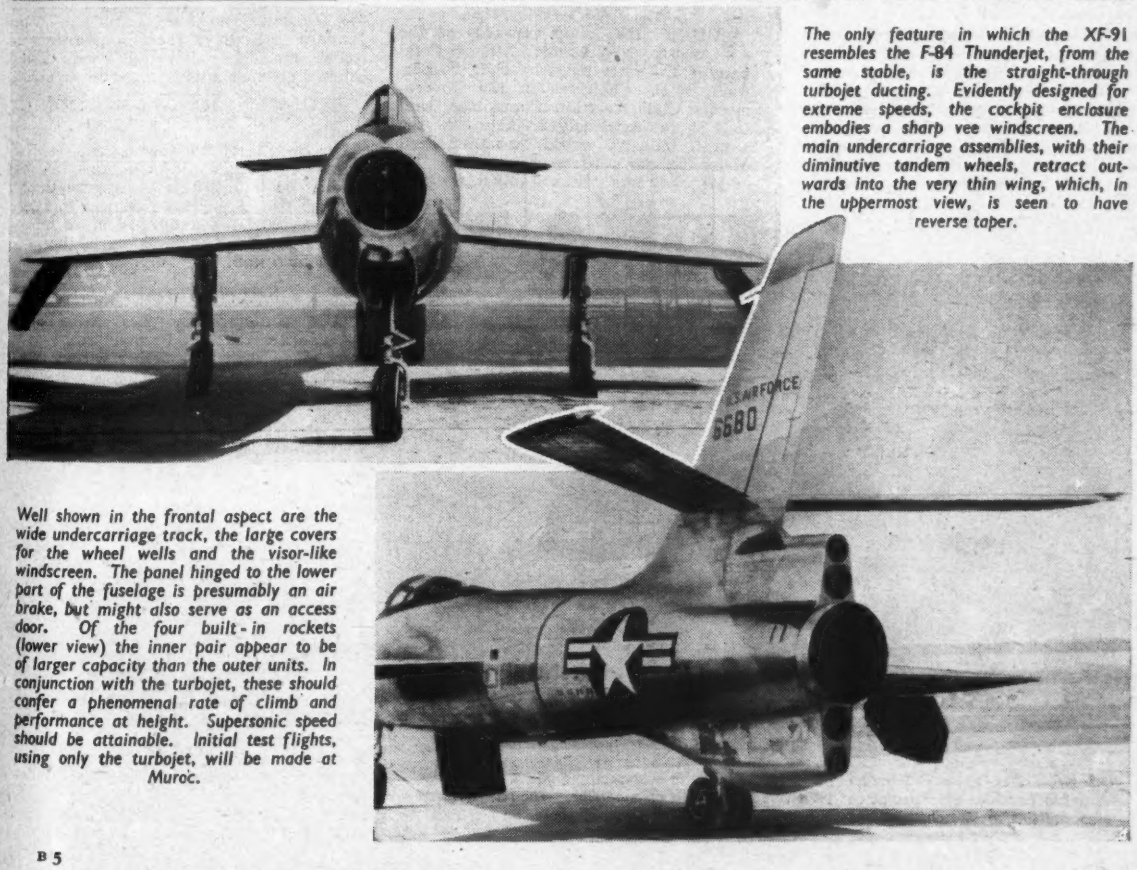
INTERCEPTER, 1949

A Turbojet-cum-Rocket Republic with Reverse-Tapered Wings

EVEN in these days of Wellsian realization the Republic XF-91 intercepter depicted on this page can be described, without overstatement, as a sensation. Not only is the basic layout of bold conception, but novelties abound in the design of the wing, undercarriage and cockpit enclosure and in the disposition of the battery of four rockets.

The XF-91 is a very highly specialized type for short-range, local-defence daylight interception. An official statement suggests that it will be capable of "combating enemy bombers and such missiles that come within its range and capacity."

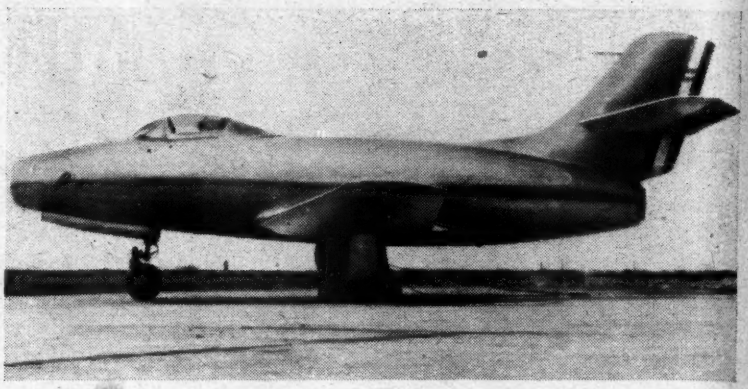




The only feature in which the XF-91 resembles the F-84 Thunderjet, from the same stable, is the straight-through turbojet ducting. Evidently designed for extreme speeds, the cockpit enclosure embodies a sharp vee windscreen. The main undercarriage assemblies, with their diminutive tandem wheels, retract outwards into the very thin wing, which, in the uppermost view, is seen to have reverse taper.

Well shown in the frontal aspect are the wide undercarriage track, the large covers for the wheel wells and the visor-like windscreen. The panel hinged to the lower part of the fuselage is presumably an air brake, but might also serve as an access door. Of the four built-in rockets (lower view) the inner pair appear to be of larger capacity than the outer units. In conjunction with the turbojet, these should confer a phenomenal rate of climb and performance at height. Supersonic speed should be attainable. Initial test flights, using only the turbojet, will be made at Muroc.

HERE AND THERE



JET HURRICANE: Although French jet aircraft are not expected to be in production before 1951, the Nene-powered Dassault 450 Ouragon speaks well for design progress. It made its first flight on February 28th.

A New Number

THE designation B-56 is reported to have been allotted to the piston-plus-jet powered version of the Convair B-36 bomber mentioned in *Flight* of February 10th. Four turbojets will be mounted in "pods" beneath the wings, after the fashion of the Boeing XB-47, to give extra speed for emergencies.

Film Finale

THE last programme in a series of film shows given by Mr. William Courtenay for members and associate members of the Royal Aero Club will take place at Londonderry House on March 15th at 6.15 p.m.

Mr. Attlee Impressed

THE Prime Minister, Mr. Attlee, flew from Northolt to Gatow in a Transport Command York last Friday for a week-end inspection of the Air Lift. Before flying to the Celle, Lubeck and Wunstorf bases, he remarked upon the close co-operation between the British and American air forces. Mr. Attlee described the Lift as one of the wonders of the world. "There has never been anything like it before," he stated.

Second Saab-29 Flies

THE second prototype of the Saab J-29 Ghost-powered jet fighter made its first flight on February 28th. Like the first machine, which has recently been overhauled, it was flown by S/L. "Bob" Moore, the company's chief test pilot.

M.o.S. P.R.O. Leaves

MR. R. B. WILLIAMS-THOMPSON, who is well known not only to Pressmen but to the aircraft industry as a whole, has recently resigned from his post as chief information officer of the Ministry of Supply. He is now on holiday in Greece, and on his return will take up an appointment as managing director of Gregg Schools, Ltd.

Prediction

ADDRESSING shop stewards of the Armstrong Whitworth Aircraft Company at Coventry recently, F/L. F. Beswick, M.P., Chairman of the Government's Civil Aviation Committee, said that it was extremely unlikely that the aircraft industry would be nationalized under Labour's next programme. He added, however, that a tighter check would have to be kept on the expenditure of public moneys by some of the private concerns.

Brabazon Début

TAXYING trials of the Brabazon I are expected to begin during May, and it is hoped that the first flight will follow shortly afterwards. The vicinity of Filton airfield will probably be prohibited to casual aircraft during the tests.

As previously announced, the "Brab" will carry a crew of eleven, consisting of two pilots and nine test engineers. The preliminary trials and subsequent flights of this promising and eagerly awaited giant will be fully reported in *Flight*.

Not Satisfied

ALTHOUGH his 2,406-mile flight from Honolulu to San Francisco last January set up a new long-distance record for light aircraft, Captain Bill Odom's original intention, to cover non-stop the 5,000 miles from Honolulu to New York, was frustrated by adverse weather.

His Beechcraft Bonanza has now been fitted with larger wing-tip tanks, each holding 62 gall (which brings the total tankage to 288 gall) and he will shortly make a second attempt. On his previous flight, Capt. Odom was in the air for 22 hr 6 min.

French Recovery

OUR contemporary *Les Ailes* announces that six French prototypes have made their first flights within two months. The aircraft named are, in addition to the Dassault 450 fighter illustrated on this page, the Roitelet-Dabos ultra-light aircraft, the Nord 1400 flying boat and three transports, the CM 100, NC 271 and Bréguet 761.

This progress offsets the setback suffered by the scrapping of production of the SNCAC 211 Cormoran transport, which was announced by M. Ramadier, the French Defence Minister, during a debate on defence estimates recently. M. Moreau, the Secretary for Air, stated that Vampires would be in mass production in France within a year.

Australian Affairs

AIR MARSHAL G. JONES, the Australian Chief of Air Staff, stated in Canberra last week that Australian-built Vampires, which are Nene-powered, will begin to flow from the factories next month. He added that advanced plans are being made for producing a later type of aircraft. This is believed to be a ver-

U.S. NAVY'S LATEST: The Piasecki HJP-1 helicopter with overlapping tandem rotor blades. With blades folded the machine can be lowered on the lift of a carrier. The HJP-1 is here seen hoisting a stretcher patient on board. It can carry three of these, or five seated passengers.

HERE AND THERE

sion of the Hawker P.1040 intercepter.

The first Staff College for officers of the Royal Australian Air Force is to be opened in May. Its training programme will be modelled on the R.A.F. pattern, and constant liaison with R.A.F. establishments will be maintained.

The Blue Look

THE U.S. Air Force is to introduce uniforms in a new slate-blue shade, known as Uxbridge blue, which is said to be slightly darker than the R.A.F. colour. Uniforms for officers and men will differ only in rank insignia, and oxidized silver buttons, light blue shirts, and "midnight blue" ties will be worn. Replacement of the present khaki is expected by September next year.

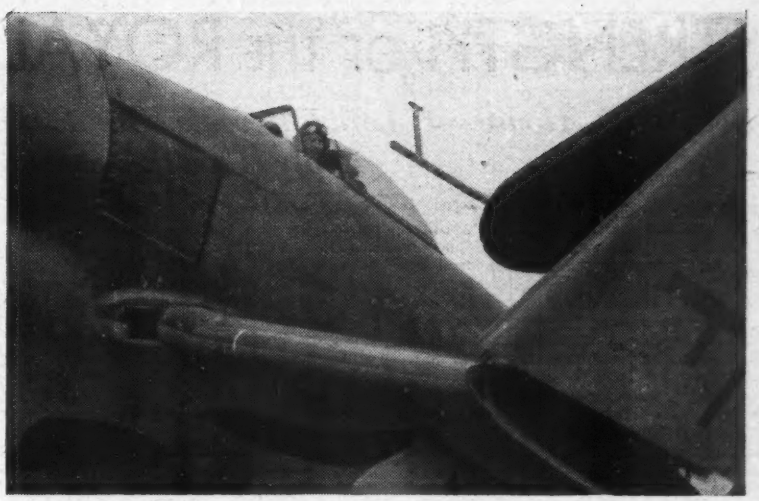
Competition Rules

AS mentioned in these pages on February 10th, the Royal Aero Club has recently circulated, in booklet form, Part I of its *Competition Rules*. This first section deals with racing, aerobatic competitions and international rallies; Part II, due to appear within the next few weeks, will cover record attempts by all classes of aircraft. Those concerned may obtain copies on application to the Secretary-General, at 119, Piccadilly, London, W.1.

Contracts for Curtiss

THE Curtiss-Wright Corporation has delivered to the U.S.A.F. for testing the first Cyclone 7 to be produced under a £1,750,000 order given last summer. Rated at 800 h.p., the "7" is the smallest in the Cyclone series. It will be used to power the 266 North American T-28 basic trainers ordered "off the drawing-board" last spring, as the result of a design competition. The first T-28 is expected to fly next September.

Another Curtiss-Wright contract calls for the reconditioning of 100 C-46 Commando transports at £7,500 each. The Corporation is also working on guided missiles.



POWER TO ITS ELBOW: In last week's issue of Flight, W/C. Maurice Smith gave flying impressions of the Blackburn Y.A. 1. He reports that a first experience of power-folding wings while taxying provided a quite extraordinary sensation. When this photograph was taken he had just re-selected "spread."

Strictly Non-Political

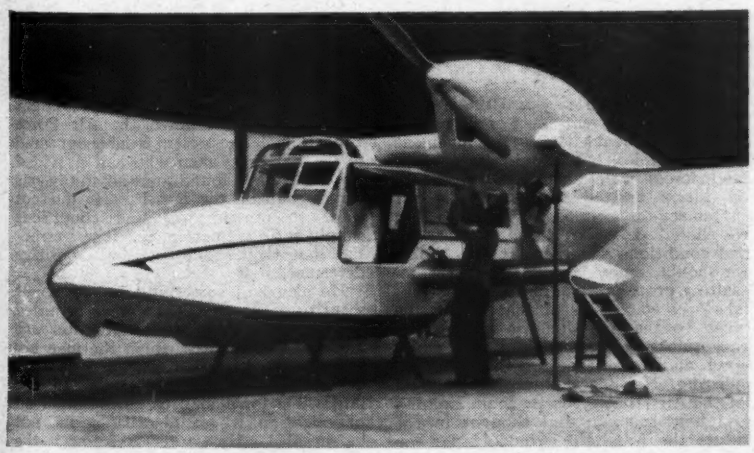
IN the Volga Steppe area of Russia, flying and hunting have been combined in a war on wolves. One pilot, Sergei Gorbunov, is reported to have shot 250 out of 1,200 wolves exterminated during last year's season, and this year he already shares with another pilot a bag of 87. The types of aircraft and guns used have not been specified.

Orkney A.T.C. Proposal

TWO staff officers of No. 66 (Scottish Reserve) Group recently visited Orkney to discuss the formation of a County of Orkney A.T.C. unit. They were entertained by the Lord Lieutenant, Sir Sutherland Graeme, and members of the Orkney Flying Club. It was stated that while there appeared to be a considerable local desire, and many potential members, further preliminary investigations were required to ensure that an efficient unit could be started. In the meantime those who are interested have been asked to watch for Press notices and advertisements, or apply to the County Youth Organizer.

Auster Duster

THE latest sub-type in the Auster Autocrat series is the J.5, which has been developed for crop-dusting and spraying. Equipped for dusting, the J.5 can carry up to 400lb of D.D.T. powder and make a distribution as fine as ½lb per acre, while the spraying version can cover 120 acres with 40 gallons of liquid. Both methods offer wide possibilities for pest control or soil fertilization.



TAKING SHAPE: The mock-up of the Sponson Tribian II 5/6-seat amphibian, built by the Tiltman Langley Laboratories at Redhill. This version has a wing span 4ft greater than that of the 3/4-seat Tribian I, and will be powered by two Gipsy Queen 6s or Cirrus Bombardiers. Later export models for Canada and America may have Continental engines of equivalent power.

News in Brief

AT the R.A.F. College, Cranwell, on February 22nd, Senhora Portella, professor of English at the Rio de Janeiro School of Aeronautics, where the Cranwell cadets' Brazilian counterparts are trained, presented a pennant to the Commandant of the College, A. Cdre. Beamish. The pennant is a token of esteem from officer air cadets of the Brazilian Air Force.

* * *

Representatives of 670 branches will attend this year's annual conference of the R.A.F. Association, to be held on June 11th and 12th at the Winter Gardens, Margate, under the chairmanship of Air Marshal Sir Richard Peck.

* * *

Following a recent announcement, it should be made clear that applications for B.P. carnets, and other enquiries in connection with the B.P. aviation fuel service, should be addressed to Shell-Mex and B.P., Ltd., Shell-Mex House, Strand, London, W.C.2.

* * *

Mr. Hugh C. Tett, managing director of the Esso Development Co., Ltd., since 1947, has been appointed general sales manager of the Anglo-American Oil Co., Ltd.

STRENGTH OF THE ROYAL AIR FORCE

Debate in House of Lords Reveals Great Uneasiness : Government Reply Unsatisfactory

THE fact that there was to be a debate on defence "in another place" the next day, and one on the Air Estimates shortly, was used by the Parliamentary Under-Secretary of State for Foreign Affairs, Lord Henderson, as an excuse for not telling the House of Lords anything about the R.A.F. in the debate held on March 2nd.

VISCOUNT TEMPLEWOOD (formerly Sir Samuel Hoare) moved a resolution "That this House presses upon His Majesty's Government the urgency of strengthening the Royal Air Force in the interests of Home Defence, Western Union, and Atlantic security." Lord Henderson did little except utter the usual platitudes about the Government agreeing, being fully aware, etc.

The defence strategy of the Western Powers was criticized by Viscount Templewood as a modern Maginot Line out of keeping with all the dominating lessons left by the war. He quoted General Eisenhower's dictum that "the decision of a future conflict would be determined by our ability to act and react in the first sixty days." He then turned to the subject of secrecy. In many years' association with Defence Departments, he remembered no Government as secretive as this. They had not followed the previous practice of taking the leader of the Opposition into their confidence. All they had had was a series of White Papers; he had never seen such White Papers—they were so white that there was not a spot of red blood nor an inch of bone in any of them.

When he was Secretary of State for Air he never failed to put before the country the programme and the number of squadrons existing and proposed. The present secretiveness, plus statements by the Air Minister that standards of morale in the R.A.F. are not entirely satisfactory at present, was having the worst possible effect on the work of rebuilding the R.A.F. They did not ask for certain technical details, but they did ask that the public should be told what is our Air Force programme, how it is going to be carried out this year, and how long it will take to complete.

Recruitment

If voluntary recruitment was to succeed, the public must know enough to realize the urgency of the problem. The dominant Air Force in the world was the American, and if anyone had the need to conceal its strength it was America. But America had not done so. The result was that whilst in this country there was secretiveness and bad recruiting, in America there was publicity and good recruiting. The number of voluntary recruits had been so great that standards had to be raised and numbers restricted. Basic pay was high, extra pay was given for hazardous service, insurance premiums were reduced, and pay allowances were exempt from taxation. In this country we would have to reconsider this question of pay.

In a debate last November the number of squadrons needed had been suggested by him and by Viscount Trenchard. Viscount Templewood now thought that we should have a programme comprising 180 squadrons to represent the British Commonwealth. If it were clear to the world that we had this great Force, he said, Western Europe would breathe a sigh of relief.

VISCOUNT TRENCHARD agreed with every word Lord Templewood had said. He begged the Minister to think over the question of secrecy and to resume publication of the *Air Force List*. We should never get young men to join the R.A.F. until they knew the Government was determined to have such a Force for the defence of the country as would do its job. He thought there was nothing wrong with the morale of the R.A.F., and it was the privilege of the Service to grumble.

Economy

On the subject of economizing, Lord Trenchard said there should be one Air Force. Was the Fleet, he asked, as vital to-day against an enemy that is not a naval Power in any sense of the word? In connection with National Service Lord Trenchard said nothing under three years was any good. For the regulars he thought there should be varying lengths of service.

Service pay should be increased. If they wanted the right man in the R.A.F. they must pay more than in the other Services. Mechanics were highly skilled and should be more highly paid. Any mistake made by a mechanic, whether in peace or war, was lethal. That responsibility alone justified greater pay.

Turning to the question of equipment, Lord Trenchard said that while he hoped they were pressing on with the production of jet machines, he urged that they should keep in production a steady flow of Lincolns and Lancasters. Disaster lay ahead if we did not build up and maintain a Bomber Force more powerful than was the one we had at the beginning of the last war.

VISCOUNT PORTAL OF HUNGERFORD stressed the deterrent effect of air power. He agreed it could defeat the movement of great armies, but only in cases where land forces were also engaged in the opposition and able to profit by air supremacy on their side. He agreed that we should give the R.A.F. better pay and conditions and then, at one stroke, we should remove the whole of the recruiting problem. He pleaded for "prefabs" or something of that sort to be given to the Air Ministry and erected very quickly. That would attract many good and experienced N.C.O.s to re-enlisting. He suggested the Navy should let the Air Ministry do its shore training and housekeeping, and thought in the future the Admiralty would be far too busy with other matters to be bothered with anything so out of date as aircraft carriers.

LORD VANSITTART said Stalin is contemplating war just as clearly as Hitler did. Hitler could have been stopped, and so can Stalin. A powerful Air Force was the cheapest and easiest way of doing it.

VISCOUNT SWINTON partly agreed on overdoing secrecy regarding first-line strength, although he would not divulge the strength of reserves. Before the German war we were right in concentrating on fighters, but to-day the emphasis was different. The first line of defence was attack, and that meant an adequate bomber force ready for immediate action. We had the lead, in quality, in bombers and fighters before the war. He was sure it was not the fault of the designers and constructors if we did not still possess that lead. He asked the Government "Have we now a two-seater jet night-fighter? If not, when shall we have one?" Referring to the *Statement on Defence* he asked for a clear statement as to whether our shadow factories are in being, with their tools and plant on a care and maintenance basis, ready to function.

In the absence of figures relating to strength in aircraft, it was difficult to assess the waste of manpower, but he thought the proportion of aircraft to numbers of personnel was bad compared with 1939 (100,000 men, 2,400 first-line aircraft).

LORD GIFFORD suggested not enough was being done to encourage recruiting from the Commonwealth. As the only naval officer to speak that day, he wondered how far Lord Portal wanted to go. If he meant that preliminary training of the Royal Naval Air Service might be combined with that of the R.A.F., nobody would quarrel with him, but he would like to ask whether he thought his brother, Vice-Admiral Portal would agree to handing over Lee-on-Solent and all his naval air stations to the R.A.F.

Quality

THE EARL OF SELKIRK emphasized the importance of quality. "There is nothing," he said, "of greater importance in the Air Force than the quality of the personnel. If you lose quality you might just as well shut down the Air Force altogether." The present trouble appeared to be that those men who had provided the quality had found more advantageous careers outside the R.A.F. He did not want to present pay and conditions simply as an attraction, but it was essential that they should not be a positive deterrent.

He also had something to say about security. When A.F.C.s were awarded for the Berlin Air Lift, no mention was made of the units to which the men belonged. Had the identity of squadrons become a matter of security? It was impossible for a man to be proud of an organization whose identity could not be revealed. He wanted to know if the knowledge obtained by research was being applied, and quoted the statement in the Finletter report that "a second-best Air Force is almost as bad as none at all."

LORD HENDERSON, Parliamentary

Under-Secretary of State for Foreign Affairs, replied for the Government. He spoke for 35 minutes and said nothing whatever worth saying, except that the Government agreed with Lord Templewood's Motion and was fully alive to the need for, and actively engaged in, developing and strengthening the Royal Air Force. The Government still thought it unwise to give information which would be of value to an ill-wisher.

VISCOUNT TEMPLEWOOD congratulated the Secretary of State for Air (Mr. Arthur Henderson) upon having so loyal, so efficient and so pleasant a brother (Lord Henderson). He did not think he had ever heard "No" said at such great length or so pleasantly. They understood there was to be a Defence Debate in another place the next day, and presumably there would be a debate on the Air Estimates next week or the week after. They must therefore reluctantly retain their anxiety till then, but he gave warning that they would look for much more specific answers than they had had.

He had two or three comments to make on what Lord Henderson had said. He had stated that we were spending £34 million more this year on the Air Force, but until further details were made known it was impossible to say whether this was a sign of grace or merely an example of extravagance. What they did see was a huge number of men and women in the Service, and a further army of civilians, but they could not tell whether this great army, much greater than anything contemplated in the past, was being properly and economically employed. If they knew the number of bomber, fighter and transport squadrons, they would have some test of this huge expenditure of men and money.

Secrecy

On the subject of secrecy, Lord Templewood said Lord Henderson had told them the Government would not give information so long as other countries did not give it. Did anyone imagine that Russia was ever going to publish information about anything? It meant, therefore, that this country would never have any information of that kind. "I very much hope," Lord Templewood said, "That the noble Lord will point out again to his brother—with all the force that comes from one brother to another—that unless the country is given more information we shall never stimulate the spirit of recruiting; we shall never get the air sense stimulated in the people, and we shall never be able to get the Air Force into the same position as that which the Navy occupied half a century ago."

As to pay and allowances, Lord Templewood said the efficacy must be judged not by general principles, nor by selection of figures from this or that document, but by the actual results in providing enough skilled men for a very technical service. He looked at such sinister facts as the fact that Cranwell today, for the first time in the history of the Air Force, was only two-thirds full. He looked on the further fact that, on the admission of Lord Henderson himself, Halton was only half full. That made him think there was something wrong with the conditions in the Air Force, and that the right men and boys were not being attracted in sufficient numbers. His friends and he would await results, and then hope to resume the discussion.

DEFENCE DEBATE

Doubts Expressed Concerning Any Real Policy : Are Huge Sums Being Frittered Away?

THE debate on Defence which occupied the House of Commons on March 3rd cannot be said to have achieved any very notable results. Mr. A. V. Alexander, Minister of Defence, made a speech lasting more than an hour, but added very little to the information given in the *Statement on Defence* published recently (*Flight*, February 24th). He emphasized that the larger portion of expenditure on research and development is devoted to new types of aircraft.

MR. OLIVER STANLEY complained that after hearing Mr. Alexander's speech he knew little more than he did after reading the White Paper, just as he knew practically nothing more after he had read that paper than he did before he ever looked at it. He found no indication as to what was the real state of the defences for which we were paying so highly. What began as defence against a potential enemy might quite well end as defence against a potential critic. The question they were all asking was: was there a plan behind all this, and if so, how were we getting on with it? There was no mention of bombers in the White Paper, and when taken in conjunction with the reports on the air exercise before Christmas, this caused doubt as to whether we had an adequate striking force.

Mr. Stanley doubted that the Ministry of Defence was really working as it was intended to work. Under the old system, each Service put up its Estimate separately. The new way was to be through the Ministry of Defence, with a co-ordinated coherent plan for the Services as a whole. It seemed the old way was still being followed.

MR. FRANK BYERS thought the information given the House was far less than that which potential enemies must have in their possession. He referred to the manpower figures, which were ambiguous and misleading, and pointed out that in the R.A.F. 35 per cent or more will be National Service youths of under 20. This was a direct result of conscription and of relying on the National Service principle.

MR. A. R. W. LOW complained that the Minister of Defence was still wedded to the long-term policy, which was mentioned first in the White Paper. The impression was that the long-term features of defence still had priority over the short-term features.

MR. E. A. A. SHACKLETON did not think that giving the number or establishment of squadrons in the Air Force would help in assessing the efficiency of our defences. Availability, serviceability and other matters were the real test.

MR. A. CRAWLEY thought there was little doubt that the Russians had 400 first-line modern bombers, not jet bombers but so fast that only jet fighters could put up a defence against them. We could not afford both fighters and bombers, and he thought we ought to concentrate on fighters, above all jet-propelled night fighters. Our two day-fighter types were the best, but we did not have them in adequate numbers. He made the statement that we were developing as many prototype jet bombers as prototype jet fighters. He even suggested that consideration should be given to America using our fighter types. The American types were faster but did not climb fast enough, and could not be used in this country because our runways were not long enough.

In bombers, too, we should co-ordinate our efforts. If Bomber Command used American bombers, fitted with British jets experimentally, it would make more sense than if we competed with one another. He thought the Government was thinking along these lines, but did not believe they were taking action energetically enough and fast enough.

BRIGADIER PRIOR-PALMER agreed with this view, except for the light and medium bomber classes, which would be required for use over battlefields, and which types of aircraft we were eminently suited to produce in this country.

MR. RONALD CHAMBERLAIN did not expect information about technical details, but he regretted the needless obscurity as to an overall plan and the general direction of defence.

BRIGADIER A. H. HEAD said they were being asked to give the Minister of Defence £750 million and 1,500,000 men. With that much money and those men, why had there been produced so little that could fight? The White Paper was a series of disconnected statements with a lot of *ad hoc* measures for each of the three Services. The House did want to know that there was a plan.

MR. KEELING referred to the statement by Lord Henderson last November, in which was recognised the dominant importance of air power. The Minister of Defence had not repeated that statement in his White Paper, nor did the White Paper show any sign that it was going to be translated into action. He asserted that as Western co-operation grew, so did the case for increasing British air power. It would encourage our European allies and it would reassure France. Russia had almost inexhaustible supplies of men, which she did not hesitate to use prodigally. The only way we could nullify that advantage was by air power. A strong bomber force, instantly ready to attack enemy bases, war industries and rocket sites was alike the strongest deterrent to an aggressor and the best hope of victory if war came.

THE PRIME MINISTER did little to allay the fears of the critics. To Mr. Keeling he replied that the absence of any reference to the priority of the Air Force in the White Paper did not indicate any change in the emphasis placed on the importance of the Air Force.

On the question of secretiveness, Mr. Attlee repeated the claim that before the last war the Germans benefited very much from excessive information. There was danger there, and if incomplete information was given to the House, it was likely to have a misleading effect.

CLIPPER "AMERICA": Taking off from Boeing Field for delivery to Pan American Airways, is the first of 20 Stratocruisers on order for that American airline. Three more will probably be delivered to P.A.A. this month.

CIVIL AVIATION NEWS

S.A.F.E. Service to Shanghai: Discussions to Relax I.C.A.O. Design Standards

NORWEGIAN SERVICE TO FAR EAST

PERMISSION has been granted by the Norwegian Government to South American and Far East Airlines (S.A.F.E.) to operate scheduled services between Norway and the Far East. It is understood that the route will be from Oslo and/or Stavanger through Amsterdam, Geneva, Rome, Cairo, Basra, Karachi, Bombay, Calcutta, Bangkok, Hong Kong to Shanghai. The contract is to operate for five years as from March 1st this year.

The airline was formed in March, 1946, by Braathens, the Norwegian shipping company, when three Skymasters were purchased from the United States. In 1947 a Dakota and another Skymaster were added to the fleet and last August the company made its first flight from Norway to Caracas, Venezuela, via Reykjavik, Gander and Bermuda and established a semi-regular service.

Until recently, maintenance work had been carried out by K.L.M. at Schiphol Airport, Amsterdam, but the company now has its own maintenance organization at Sola Airport, Stavanger. S.A.F.E. operated at a profit during its first year.

THE AIMS OF S.I.T.A.

THE establishment of a new company to assist and improve communications for civil aviation on the Continent was announced in *Flight* of March 3rd. The primary object is to establish a system of land lines within the Continent and radio links with other countries to eliminate the present excessive delays in dealing with administrative messages amongst the air lines. There will also be a resultant benefit to the public through speedier handling of reservations.

Eleven airline companies—A.B.A., D.N.L., D.D.L., B.E.A.C., B.O.A.C., B.S.A.A., K.L.M., Sabena, Swissair, T.W.A. and Air France—have formed the new company, which will be known as the Société Internationale de Télécommunications Aéronautiques. It has been thrown open to all members of I.A.T.A. and on its board are represented the British company, International Aeradio, Ltd., and its American counterpart, Aeronautical Radio Inc. M. Francoise de Keghel of Sabena has been elected chairman and Mr. V. Wolfson, of B.E.A., who is also director and deputy chairman of International Aeradio, Ltd., is on the Executive Committee.

It is intended that members shall pool their existing communication facilities, so that new means of communication will be available to all operators—means of which they could not otherwise take advantage, owing to the high cost of installation and maintenance. In the initial stages the company will survey the present situation on the Continent and, after policies have been agreed, it is hoped to start work this summer. One of the first undertakings will be to provide direct communications between the main European airports.

The articles of association state that no one company or group of companies of the same nationality can obtain a majority vote and that any resolution is to be carried by a majority of those present at a meeting with the casting vote held by the chairman. The administrative office of the company will be situated in Paris, but the head office will remain at 192, Rue Royale, Brussels.

WEST AFRICAN AIRWAYS REPORT

PREPARATION of an annual report for the year 1946-47 was deferred since in that first year only preliminary work in the West African Airways Corporation was possible and the first aircraft was not delivered until September 14th, 1947. The annual accounts attached to the report for the two years ended March 31st, 1948, showed a deficit of £76,595, as approximately expected for the period of development.

In view of the short period and the rapid development of new services coupled with unavoidable teething troubles, no useful deductions can be made from the figures. The Board state, however, that there are indications that the estimated revenue for 1948-49 will be realized. With a senior staff of 129 and a junior staff of 795, West African Airways Corporation operated seven de Havilland Doves over seven routes, totalling 2,632 miles. During the year, 1,804 passengers were carried and on scheduled and all other kinds of flights a total of 245,269 miles were flown. During the period there were no accidents which were fatal or which involved injury, but two aircraft were damaged.

W.A.A.C. services are of the omnibus type with passengers getting on and off all along the route and under such conditions it is difficult to obtain a high load factor. On scheduled services the load factor was 46.6 per cent throughout the period and the overall average on all flying was 55.8 per cent.

I.C.A.O. DESIGN STANDARDS

THE International Civil Aviation Organization Airworthiness Division is preparing performance and design standards for four separate categories of transport aircraft. It is believed that under certain conditions it will be possible to modify the very high standards now recommended for transport aircraft without prejudice to flying safety or efficiency. Aircraft built for short distance operation, for example, would not be called upon to maintain height with one engine inoperative with such a wide margin of safety as an aircraft used on long international flights across seas

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or mountains, since short-haul aircraft are always relatively close to a landing field.

By such a relaxation of this and certain other provisions in the present airworthiness codes the cost of construction and operation for short-haul airliners could be reduced. This is the aim of the I.C.A.O. discussions. The four categories of transport aircraft will include three for passenger carrying purposes and one for cargo only. Distances between airports, the *en route* facilities and the varying air temperatures in different parts of the world must all be considered in the determination of airworthiness standards, and the I.C.A.O. Operations Division is co-operating in the current discussions.

BREVITIES

AMERICAN Overseas Airlines are to have a ticket office in Munich in addition to those already established in Berlin and Frankfurt. It is hoped that the new office will be opened on June 15th.

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Discussions are proceeding between H.M. Government and the Israeli Government for the resumption of air services to Israel. If agreement is reached between the two governments, B.O.A.C. will probably reopen services to Lydda airport.

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Mr. Lindgren stated in the House of Commons that the reports of the Helmore and Wilcock Committees were under discussion with other Government departments, and both reports would be published as soon as possible.

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Discussions between the Ministry of Civil Aviation and representatives of local authorities in the Prestwick area have resulted in a third runway being approved as part of the expansion programme. Measuring about 2,350yd long and 65yd wide, the new runway will be longer but narrower than the present main runway, and will extend from a point some 500ft along the main Prestwick runway and end near the main runway at Heathfield Airfield, in a south-south-west direction. In all probability the project will not be started for two years.

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B.O.A.C. traffic figures for 1948 show that the Corporation carried 3,166 tons of cargo and 1,767 tons of mail between Europe and America, Africa, Asia and Australasia. Much of this volume of traffic went through the B.O.A.C. cargo-handling unit at Airways Terminal, London, where some 1,000 enquiries a week are received from consignors. The booklet, "Air Freight," recently revised, summarizes the facilities, conditions of carriage, documentation, and C.O.D. systems which are in operation. It is obtainable free of charge from the Mail and Cargo Officer, B.O.A.C., Airways Terminal, S.W.1.

"Flight" photograph.

PAKENHAM PALACE: Some 1,700 administrators in the Ministry of Civil Aviation will move from dispersed quarters in London to Belfort House, Theobalds Road, London, W.C.2, in the later part of this year. The building will be let to the M.C.A. through the Ministry of Works.

Baltairvoy, the air-voyage cargo charter-party approved by the Air Freight Advisory Committee and the British Air Charter Association, Ltd., was placed on sale from February 24th and may now be purchased from S. Straker & Sons, Ltd., 49, Fenchurch Street, London, E.C.3.

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By a co-ordination of time schedules in four international airlines it is now possible to fly to Moscow from Paris in under 36 hours, including an overnight stop in Warsaw. Air France, in conjunction with Czechoslovakian Air Lines (C.S.A.), flies daily from Paris to Prague, and on Tuesdays of each week a service is flown by the Polish airline L.O.T. from Prague at 1315hr, reaching Warsaw at 1845. On Wednesday mornings a Russian Aeroflot aircraft leaves at 0930, arriving via Minsk in Moscow at 1740.

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The Postmaster-General was asked in the House of Commons on March 2nd if he would consider the possibility of introducing a helicopter service this summer for the delivery of mails from Kirkwall to the islands in Orkney. Mr. Wilfred Paling replied that mail services were still in the experimental stage and that the step could not be adopted. After attention was drawn to the helicopter service run by the Navy throughout the war, he said that experimental work was going on in areas where the greatest good could be done, but he was unable to say when regular services could be operated.

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It is reported from America that at the time Pan American Airways announced the purchase of American Overseas Airlines (December 13th, 1948) something in the region of £4,500,000 was offered. Included in the deal was a proviso that the U.S. Civil Aeronautics Board should approve the transaction within six months, as that represented the longest period for which the parties were willing to accept the uncertainties and financial risks involved. Pan American Airways have indicated that an attempt to make the deal an excuse for an investigation of all phases of American overseas air transport might, through inevitable delay, kill the proposed transaction without

Aeroplane photograph

DUBLIN AIRPORT: Situated only 5½ miles north of the city, Collinstown is a state-owned airport. Facilities include S.B.A. and radio beacons, and I.L.S. is in course of installation. Landing charges are 4s, per 1,000-lb maximum permissible all-up weight of the aircraft.

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it being given a hearing. Pan American have charged T.W.A.'s effort to intervene as a design to obtain routes at present covered by P.A.W.A. and A.O.A. The Civil Aeronautics Board has been asked for an early decision.

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The official opening of Air France's new Birmingham office at Elmdon Airport, due to take place last Tuesday, forms the prelude to the inauguration on Monday, April 11th, of the new Birmingham-Paris direct service in conjunction with B.E.A. The fare between Elmdon and Le Bourget is £10 and £18 return. The flying time will be 2¼ hours and Air France schedules have been timed to connect in Paris with the companies' services to other countries in Europe and to the Near East. Air France passengers will be permitted to break their journey in Paris for any period up to 15 days.

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Cargo rates on a through basis from places on routes operated by B.O.A.C., B.E.A. and their associated companies to New York and Montreal in a west-bound direction were introduced on March 6th. Through cargo rates have been in force for some time on east-bound flights. Similar adjustments to fare and cargo rates have also been made by B.O.A.C. on the Springbok service from all stopping places, through Johannesburg, to towns served by South African Airways. Passengers are provided with free accommodation at Johannesburg and are allowed the normal free baggage allowance of 66 lb.

FLYING FARMER : Mr. Sydney Bichan, a member of Orkney Flying Club and joint owner of a Slingsby sailplane, recently purchased an Auster for his personal use, but particularly to fly young chicks between the island and the mainland. Both the aircraft and the glider have been placed at the disposal of club members.

FROM THE CLUBS

AGAIN this year an air pageant is being organized by the *Daily Express*; it will take place at Gatwick Airport on Saturday, July 23rd. The display will be on the lines of last year's event, at which there were some 70,000 spectators. The co-operation of the Royal Aero Club, the Air League of the British Empire and the Royal Air Force Association has been promised. It is understood that the Air Ministry has already given consent for the R.A.F. to take part, and there will, of course, be many items in which civil aviation will be represented.

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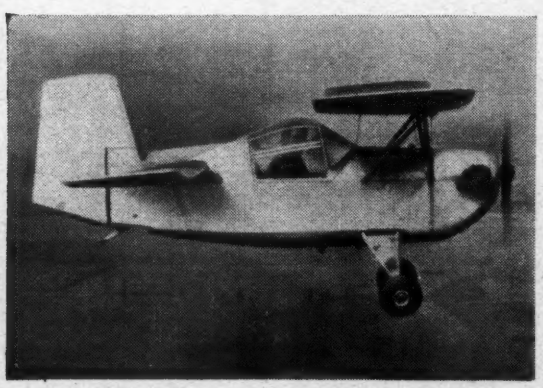
THE secretary of the Orkney Flying Club, Mr. Terence P. Hawkins, has recently had discussions with Mr. Rennick, M.C.A. Airport Commandant at Dalcross, Inverness, in connection with club accommodation at Hatston Airport. There is considerable enthusiasm since the Commandant indicated the M.C.A.'s desire to provide a club-house and hangarage on the most reasonable terms.

The club has communicated with several Scandinavian aeroclubs in view of the Scottish Tourists Board's proposals to link Scandinavia by air with Aberdeen, Kirkwall, Lerwick and Leith. Mr. Hawkins made an interesting flight on February 17th, when the C.F.I. of Loch Leven Aero Club, Mr. Kay, collected him in a Miles Gemini at Turnhouse Airport and flew him to Kinross, where he arrived half an hour after leaving the city centre at Edinburgh. The club is holding a supper dance in the Cosmos Ballroom, Kirkwall, on April 15th.



FLYING-FLEA INFLUENCE : This French light aircraft, the L.B. 7, shares with Mignet's famous "Pou du Ciel" the suppression of ailerons, but the wings are much more heavily staggered. The result is probably better stability, and certainly a better view for the pilot. The machine has an engine of 25 h.p. and is said to cruise at about 80 m.p.h.

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SOUTHEND Municipal Flying School reports very encouraging results for the last three months. In December 123 hours were flown, and, in the first two months of this year, 256 hours. During the three-month period over 35 first solos and seven "A" licences were obtained. There has been some night activity, particularly in February, when 14 hours were flown, but over the previous two months there were only six night hours.

The Flying School carries on when weather conditions would normally cause club aircraft to be grounded, since all the Austers and the Proctor are fitted with V.H.F. radio. The Tiger Moth, which is at present undergoing its C. of A., is also being fitted with radio.

Mr. S. G. Smith has been appointed deputy to Mr. Bernard F. Collins, manager and C.F.I., and Mr. R. H. Thorne has joined the school as a full-time flying instructor, bringing the strength up to two permanent and one part-time instructors. A new flying-control officer has been appointed and one of his duties will be to lecture private fliers on air-traffic procedures in this country and abroad.

An air display is being organized for August 6th, to include the usual light aircraft races, and every effort is being made to include a display by the R.A.F. Other items have not yet been decided upon, but a continuous programme will last from about 1400 to 1700 hr.

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AT the annual general meeting of the Coventry Aeroplane Club last week, Mr. H. M. Woodhams, the chairman, referred to the current rumours which were circulating on the subject of Government support for the flying clubs. He expressed the thoughts of many when he said he would believe the Government intention to do something to help the clubs only when some concrete proposals were made. Although a working party had been set up to enquire into the finances of the flying clubs and its report had been submitted to the Government, no public statement had been made.

During the past year the Coventry Club had been able to clear off the interest-free loans made by various members in 1947 and had also met its commitments under the Kemsley Trust Loan.

The new Auster was popular among the flying members but the increase from two to three aircraft had not caused flying hours to grow correspondingly, and individual utilization had not been as good as when the club had only two aircraft. During the year nine members had been passed fit for solo and some had taken their "A" licences, bringing the total qualified to 14 since the club commenced its post-war activities. Mr. F. Martin, the secretary, announced that membership had increased from 142 to 182 during the year and that a total of just over 600 hours' flying had been logged.

Night Mail: One of the first nocturnal photographs of a helicopter in flight. The under-surface of the rotor blades have a matt black surface to prevent reflection.

Illustrated with "Flight" photographs

Helicopter Night Mail

B.E.A. Peterborough-Norwich Experimental Service: Progress with Instrument-flying: S.51 Modifications

ROTATING-WING aircraft have a long-standing background of operational usage in this country, and although preoccupation with the production of military aircraft prevented our designers from devoting time to helicopters during the war years, quite remarkable progress has been made since then. Previous knowledge of, and experience with, Autogiros has been most useful, and, in addition, much has been learned from America. Many of the best features of the Autogiro, with its free-turning rotor and conventional airscrew, must now be sacrificed in order to achieve the vertical take-off and hovering flight of which the helicopter is capable; but later an endeavour to preserve the best characteristics of both types, already apparent in the Fairey Gyrodyne, may become more obvious.

Certainly much remains to be done towards simplifying and lightening helicopter controls and towards improving stability. These considerations have a very important bearing on the experimental commercial night operations which are now being undertaken by the B.E.A. Helicopter Unit. Though in helicopter-operating technique and skill this country is as advanced as, if not ahead of, any other in the world, no British-designed machine has yet completed its development trials and received a C. of A. British European Airways are therefore using, for the time being, two standard types of American helicopters.

Earlier experimental operations by the B.E.A. Unit in the West Country will be familiar, and the plans, prospects and problems of future services were dealt with in detail by Mr. N. E. Rowe in his recent lecture, summarized in *Flight* of January 27th.

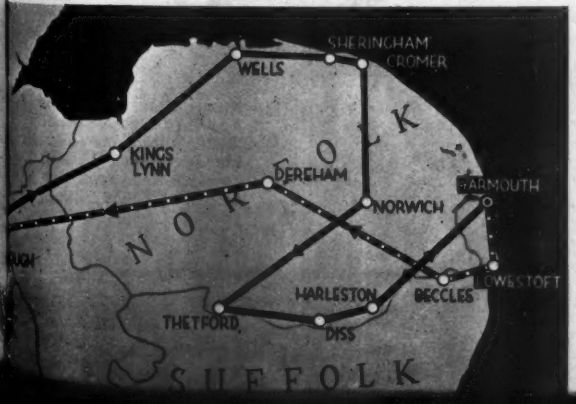
Early last May the Helicopter Unit moved from Yeovil to its present location—ten acres of the wartime F.T.S. field at Westwood, Peterborough, loaned by the Ministry of Agriculture and Fisheries. A portion of hangar, stores space and an office hut have also been taken over.

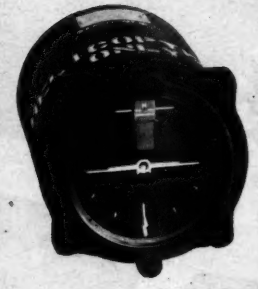
The unit operates three Sikorsky S.51s and two Bells. The latter are principally for training but occasionally undertake such work as crop "dusting" investigations. Of the S.51s one is a dual training and experimental aircraft, the other two are operational. For the scope of the work undertaken this is a very small fleet indeed. The dual aircraft has a separate rear cockpit which can be blacked out and in which a full blind panel is provided for simulated I.F. experience.

In charge of the unit is W/C. R. A. C. Brie, whose staff includes a chief experimental engineer, Mr. McClements, his assistant chief, and five pilots—Messrs. J. G. Theilmann (senior pilot), G. A. Ford, J. A. Cameron, J. S. Kay and D. H. Byron. All are ex-Service pilots, four from the R.A.F. and one, Kay, from the R.N.V.R. All had previous helicopter experience except Byron, who was a B.E.A. pilot and received his training with the unit.

During recent months the Sikorskys have been making

(Below) Out-and-return routes over Norfolk followed last year during the period of daylight mail-carrying which preceded the present experimental night service. (Right) Loading the mail before take-off for Norwich on a direct route.





(Right) The instrument panel of B.E.A. S.51s has been rearranged to accommodate a standard blind-flying layout in the centre. Above it is the compass and an illuminated cross-level bubble. For comparison the original panel layout is shown in the smaller illustration (above left). The modified Sperry horizon with adjustable pitch and roll datum is seen above.

Helicopter Night Mail . . .

regular practice flights over Norfolk and intermediate ground sites at a number of places have been prospected. At the same time intensive instrument-flying training has been in hand in the dual aircraft, and ground sites at a number of places have been prospected. Finally, navigational and landing aids of the type described by Mr. Rowe in his lecture have been under study and development. Results to date have given proof of the pilots' ability to operate in almost any weather conditions, except fog, by day or night, and to fly safely on instruments for considerable periods. They have also added proof that a scheduled service can be flown with great regularity day or night, and finally (and this is most important if helicopters are to compete with land transport) that the service is possible without the use of expensive equipment, large handling crews or elaborately planned and staffed rotorstations. Economy and simplicity of equipment and operation has been one of the guiding principles of the B.E.A. Unit.

A new phase in the experiments commenced on Monday February 21st, when the first night mail run took off from Westwood field at Peterborough to make a return flight to Norwich. The timetable is:—

Take-off, Peterborough,	22.00	Land, Norwich ..	22.56
Take-off, Norwich ..	01.50	Land, Peterborough ..	02.56

This experimental service, carrying dummy mail, will run for one month to enable the Post Office to assess the potential of the helicopter for such duties, and in the hope that a contract will subsequently be forthcoming for mail flights in the reverse (east to west) direction, which is, incidentally, into the prevailing wind.

A Good Start Made

Though it would be premature to comment on this particular experimental service, it can be said that a good start has been made in spite of trying weather. The only aids in use are V.H.F. homers, a flashing sodium beacon at Norwich and a rotating white beam at Peterborough.

Earlier, night-flying practice was carried out at Downham Market airfield, which lies on the track between Peterborough and Norwich. This station also has a sodium beacon, which can be used as a guide. The night return trip in the small hours is the more difficult on dark nights because the countryside is virtually blacked out.

The landing aid used is called a "Wiggimac" (see accompanying photograph and also the diagram on page 115 of *Flight*, January 27th), named after its inventors, B.E.A.'s experimental engineers, Mr. Wigdorchic and Mr. McClements, mentioned earlier. It produces a 100ft circle of light, a darkened wind-direction shadow bar, and a green approach-direction indicator.

Later on, for accuracy of navigation, use will probably be made of the Decca track guide, of which an experimental set has already been examined. In the meantime a broadcast of position every five minutes by the pilot, using

V.H.F. and a homing when required, is the routine for this direct service.

Pilots' N.F. and I.F. techniques naturally differ a little. It is usual to take off vertically to between 30ft and 60ft then move off on course, using instruments and (if any) horizon. Normal operating speed is 85 m.p.h. I.A.S. and, weather permitting, height is kept at about 1,000ft. A maximum airspeed of 100 m.p.h. can be used if need be.

Personal opinions expressed by some of the pilots indicate that flying on instruments is harder work than on a fixed-wing aircraft, but is nothing to worry about so long as the air is calm. In rough air it is definitely tricky and tiring. Any horizon at all is a great help at night, and minimum contact-flight conditions are about 500ft cloud-base and two miles horizontal visibility (assuming there are some lights to see).

Load makes little difference to ease of flying, although at the new approved a.u.w. of 5,300 lb the S.51 is reported rather sluggish when getting away. The most difficult flying conditions are rough air with limited visibility and a

Known as the Wiggimac, this helicopter night-landing floodlight with wind-direction shadow-bar and direction-of-approach indicator is the product of B.E.A. Helicopter Unit ingenuity.

strong head-wind. To maintain a ground speed of at least 35 m.p.h. in a strong head-wind it is necessary to fly low, which means also accepting rougher air and a smaller safety-height margin. Such conditions were met during the first week's operation on the current experimental service, but the pilots carried on in spite of them. Unless the service can take off within a few minutes of the scheduled time the flight for that night is cancelled. Strong winds as such present no problem for take-off and landing.

The B.E.A. pilots are now putting in hours at the rate of 300 per year, and all have 500 or more on helicopters. Some long-range airline pilots may put in more hours in a month than these men do in a year, and so build up huge totals, but this is another sort of pilotage: it is comparable with jet-fighter flying in the concentration required during the relatively short-duration flights. The unit's total of operations is now about 1,400 hours, and of this about 30 have been pure instrument flying (as opposed to N.F.) and five hours have been in cloud.

Small "Mods" to the S.51s

Turning now to the aircraft themselves, there are certain modifications to be observed. In passing, it is noteworthy that the unit's maintenance section is A.R.B.-approved and is quite self-sufficient, which means that "mods" can be incorporated without outside reference or delay. This approval was given in May, 1948. The S.51s have proved very reliable and easy to maintain; the work is carried out in 35-hr cycles. Major inspections fall at 200 and 400 hr, and the Pratt and Whitney Wasp engines have a 650-hr overhaul period.

The pilot's cockpit is separate from the mail compartment behind, and the instrument panel has been rearranged completely as will be explained. The "wing span" is a few feet less than the maximum allowed for light-aircraft-type lighting, so port, starboard and rear navigation lights can be mounted on the engine-compartment sides and on the tail boom respectively. A taxying or hovering lamp (starboard) and a more powerful landing lamp (port) are mounted on the main wheel struts.

Additional mail could, if necessary, be stowed in the after luggage-compartment, which is now being modified to increase its physical capacity. In the top of this compartment is a tray carrying the radio equipment, with the battery below it. At present there is room for 800 lb of mail, which is sufficient for present requirements, but space may be found to increase this figure to 1,000 lb later. With full tanks (80 gall) the maximum useful load is 618 lb, but the 3-hr safe duration then available is greater than would normally be necessary, so it should be no hardship to sacrifice a little fuel. Fuel is carried for the return journey on the present series of flights. Items from the weight schedule are (lb):—

Weight empty ..	3,800	Pilot	170
Petrol	599	Removable radio ..	22
Oil	60	Miscellaneous equipment	31

There remains the 600-odd lb at present available for mail to make up the maximum all-up weight of 5,300 lb.

A cabin heater is provided which has the additional duty of keeping the Perspex panels free from mist. On the outside a special Canadian preparation known as F.C.10 Rain Repellant is used to ensure clear vision. F.C.10 protection is applied in three stages from tubes—cleanse, bond, wax—followed by polishing. Glass requires a different preparation. Special pads are used and the finish is effective for about two months.

Reverting to the instrument-panel layout, the central position is now occupied (as will be seen in the illustration) by a standard blind-flying panel, above which has been added a smaller panel containing a compass and a large, illuminated cross-level bubble resembling the bank part of a turn-and-bank indicator. This gives a check on the artificial horizon. The horizon itself has an adjustable pitch datum (±5 deg) controlled by the top knob, and, in addition, an adjustable roll datum line controlled between the same limits by the lower knob. The normal horizon-bar is slightly modified to carry a ring-and-bead sight to simplify detection of small changes of attitude. It is, of course, the maintenance of fore-and-aft level which presents the greatest difficulty in helicopter I.F. Instrument illumination is provided by small red-shaded lamps in the roof centre directed forward on to the panel.

The opinion has been given that except for details of presentation the existing aircraft instruments are adequate for I.F. and N.F. on helicopters. Improved A.S.I. scales reading up to about 120 m.p.h., instead of 160, and a more sensitive climb indicator, are examples of desirable small refinements. Important advances must almost certainly come from improved stability in the aircraft.

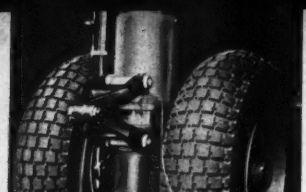
An engine failure at night would be unpleasant. In autorotation, the rate of descent is about 1,200 ft/min and forward speed would be 40-60 m.p.h. If the failure occurred at below 1,000ft an uncomfortably steep and tricky turn into wind might also be required. Pilots feel that they would stand a good chance of pulling off a landing with the aid of the two emergency flares carried on the port side of the cabin. These are of the parachute type, rocket-released to carry them well clear of the aircraft.

So far as is known, there have been no serious or fatal accidents to non-military helicopters in this country, either by day or by night. This is a creditable and encouraging state of affairs which may likewise be taken as a token of eventual success for B.E.A.'s research.

Attaching the two emergency parachute flares which are fired clear of the sweep of the rotors by rockets.

The rear mail-compartment of the S.51, in the top of which is a tray carrying radio equipment.

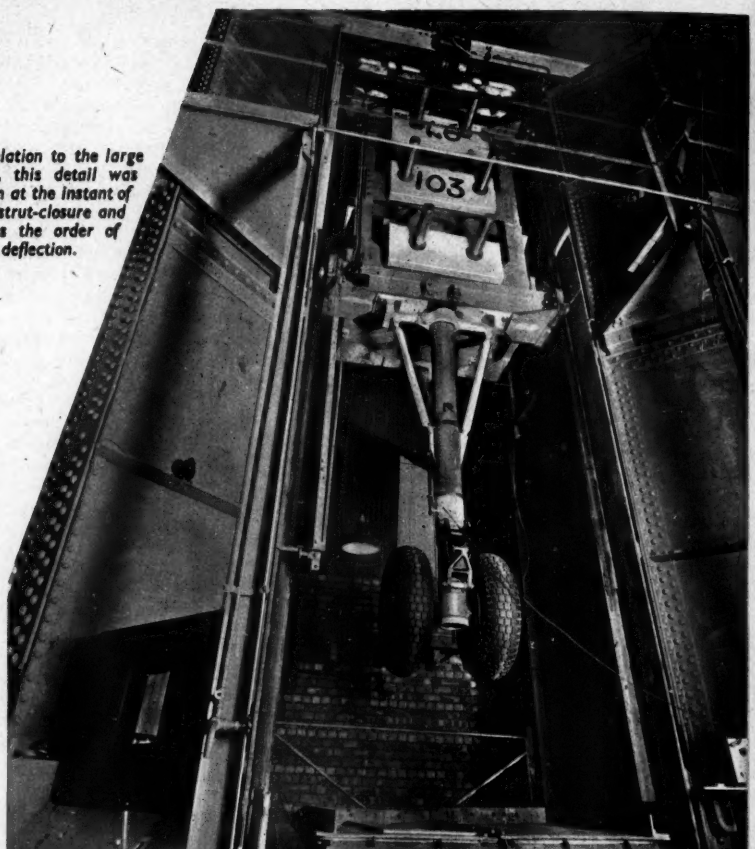
(Below) First stage in experiments to increase the mail-carrying capacity of the S.51. The battery is visible below.



In relation to the large view, this detail was taken at the instant of full strut-closure and shows the order of tyre deflection.

for HAPPIER LANDINGS

A Review of Work Now on Hand at Electro-Hydraulics, Ltd.



The Hermes IV nose undercarriage fitted in the large vertical-guide drop-test machine. The pointer indicates that the rig is set up for a free drop of 30in.

UNDERCARRIAGE manufacture on a large scale is busily engaging the attention of Electro-Hydraulics, Ltd., Warrington, where production of main and nose landing-gear assemblies for Vampires is in full swing.* The contract for Hastings undercarriages is almost complete, whilst main- and nose-strut assemblies for the Hermes IV are in production, as are the landing gears for the Short Sealand and Percival Prince. In addition to these production units, prototype undercarriages are also being built for the Firth helicopter as well as for other, still secret, aircraft.

The company was one of the first to introduce undercarriages of integral construction, of which the Halifax cast-magnesium bridge was the first example. Whilst the same principle has been retained in the more recent developments, high-strength aluminium-alloy forgings are now more usually employed in order that the highest possible strength-weight ratio may be obtained. The progress in weight-reduction as a result of these developments is tabulated hereunder:—

WEIGHT OF MAIN UNDERCARRIAGE
(Excluding Wheels, Tyres and Retraction Gear)

Aircraft	Year	All-up weight	Undercarriage weight	Percentage
Halifax ...	1936	65,000 lb	511 lb	0.790
Hastings ...	1943	75,000 lb	476 lb	0.635
Hermes IV ...	1946	85,000 lb	424 lb	0.499

** A detailed description of the machining and other production processes employed is contained in the March issue of our associated journal "Aircraft Production" and will be continued in April.*

For the undercarriage future Electro-Hydraulics are seriously concerned with multi-wheel bogie designs and, in fact, such an undercarriage, equipped with 33in tyres, is now being flight-tested on a Lincoln at Farnborough. The company is prepared to state that, for an aircraft of 100,000 lb all-up weight, the bogie undercarriage complete with wheels and tyres, as offered up to the airframe, would weigh about 100 lb less per leg than would the conventional twin-wheel unit, and about 150 lb less per leg than a comparable single-wheel undercarriage.

Reducing Landing Drag

Aside from the very real advantage of weight-saving, the multi-wheel bogie permits a wide distribution of the requisite tyre-contact area, and rather more compact stowage in the aircraft, except in the matter of length, which can usually be well afforded. A further advantage offered by the multi-wheel configuration is that, by arranging the rearmost pair of wheels (in a four-wheel bogie) always to touch first on landing, these wheels can be accelerated before the front wheels touch, and by so doing thus reduce the drag load.

In the case of an aircraft with a landing weight of 75,000 lb it has been found that the spinning-up time for one pair of wheels at 1 g is 0.067 sec for a $\mu = 0.4$, whilst it can be arranged that the second pair of wheels does not touch the ground until 0.083 sec after the first pair. Thus the maximum drag is approximately half that of the conventional undercarriage. Developments in this direction will be watched with considerable interest.

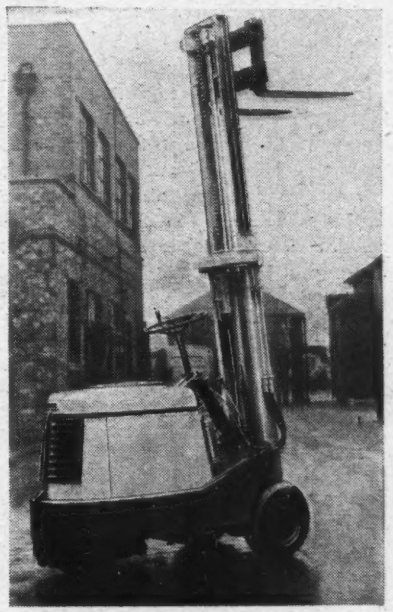
With twin-wheel nose undercarriages, interesting problems hinge on the "one-tyre punctured" case. It is fairly

For Happier Landings . . . . .

easy to show by calculation and model tests that, whilst the wheel is spinning-up on landing, the nose-strut will castor through a considerable angle and then, as the wheel becomes fully accelerated, will return almost to its normal position. It is, however, not so easy to determine the speed at which the strut will deflect, which, if hydraulic shimmy-damping is employed, is of paramount importance in that means must be provided for the fluid to escape without building up high pressures.

Research work and the employment of an energy predictor have yielded data enabling a suitable relief valve to be designed to meet the imposed conditions. One particular case may be cited as exemplifying the magnitude of the problem: the aircraft was a large tricycle-undercarriage type, and, with one nose tyre flat, the strut deflected through 57 deg, the maximum angular velocity being 32 radians/sec, that is, 1833.5 deg/sec. This ultra-rapid "flick" caused the damping fluid to be expelled at the rate of 200 cu in/sec, which, at a relief pressure of 3,700 lb/sq in, meant that the relief valve had to deal with something of the order of 150 h.p.

In order to cater for high ground-reaction values, the company has developed a duplex shock-absorber for use in nose-wheel struts, in which a second air chamber is introduced into an otherwise normal unit in such a manner that the air curve can be transferred from one compression ratio to another at any predetermined point during a stroke. The advantages of the Duplex shock-absorber are briefly as follows: (a) the maximum reaction during braked taxying is considerably reduced—in fact the dynamic effect of pitch during braking is reduced to half that experienced with the normal type of shock absorber not fitted with low-velocity orifices or twin air chambers; (b) the total travel of the nose undercarriage can be reduced.



The Mk VIII fork-lift truck shown here is the petrol-engine/gearbox-transmission type, and can lift 10 cwt to a height of 9ft.

Electro-Hydraulics have excellent drop-testing facilities in their research department. A small, beam-type drop-test machine accommodates undercarriages suitable for aircraft up to approximately 10,000lb all-up weight, as well as tailwheels, whilst a large, vertical-guide machine is capable of handling undercarriages for aircraft up to approximately 100 tons a.u.w. The vertical-guide machine, which was manufactured by Rubery Owen, Darlaston, to the designs of Electro-Hydraulics, Ltd., is 35ft high and is stressed for a maximum vertical reaction of 150 tons, with side loads of 0.3 and drag loads of 0.4 vertical reaction.

Research naturally forms a large part of the company's activity, and although that concerned with hydraulic systems is, of course, confined chiefly to specific lines of inquiry applicable to given aircraft installations, development research on such things as pumps and seals does, however, go on constantly.

It is generally felt that the optimum pressure has not yet been reached and may well lie between 4,000 and 5,000 lb/sq in, having regard to the strength of materials now available, the pipe sizes required to transmit the necessary fluid horse-power and the many other factors involved. A system operating at a pressure of 3,000 lb/sq in, with a relief pressure of 3,700 lb/sq in, is already in operation, and the time is not far distant when a system operating at 4,000 lb/sq in will, in the view of Electro-Hydraulics, be an accomplished fact. Towards this end, the company are proceeding with work on the design of an engine-driven pump employing a novel principle which will be suitable for these higher pressures.

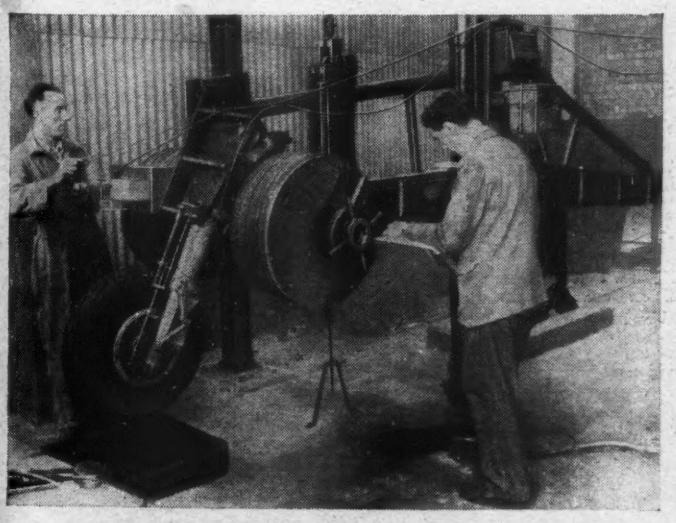
Electro-Hydraulic Valves

Considerable attention is also being devoted to the development both of pneumatic and electrical equipment, and perhaps the broadest field of activity in the last-mentioned direction is in the designing of electrically operated hydraulic and pneumatic valves. Apart from the electro-hydraulic valves designed for incorporation in aircraft systems, the company has produced a self-contained valve for use in controlling fuel-flow supply to the torch ignition on the Armstrong Siddeley Python and Mamba gas turbines. A wide range of valves designed especially for torch ignition is available, such types being fitted to all Rolls-Royce gas-turbine units. They incorporate a self-contained atomizer and filter and operate at a terminal pressure-drop of 6 v, although they are temperature-rated at 29 v.

One of the more interesting lines of exploration at present under way is that of powered controls, several schemes, ranging from the conventional type of power system to large electrically-controlled units being now in the development stage. The conventional assister unit consists of a hydraulic jack and selector coupled into the normal, manual-control linkage in such a way that mechanical follow-up and cut-off is obtained. The unit incorporates a device enabling the pilot to revert to manual control in the event of hydraulic failure. Units of this type have been built in small quantities largely utilizing poppet-valve selectors, special valve forms having been evolved which eliminate "judder." When the unit is at rest, all the selector valves are closed and a high degree of irreversibility is maintained by the trapped fluid in the jack.

In the pure powered-control system, the mechanical linkage between the pilot and the control surface is replaced by an electrical signalling system which transmits signals dependent on error. The displacement error between the two signalling devices is used to control the position, direction and rate of movement of the control surface.

Another activity of Electro-Hydraulics is the production of fork-lift trucks, models being available in a range of sizes from 10 cwt up to 2 tons capacity, and in petrol-engine/gearbox, petrol-engine/electric, and all-electric versions. One of the refinements of these trucks is that, in conjunction with hoists varying between 9 and 12ft, the fork can be tilted laterally in order to coincide with the ground angle of tailwheel aircraft, and so facilitate loading and unloading with a sloping floor.



Complementing the large vertical rig is this smaller beam-type machine for drop-tests at weights up to the equivalent of 3,000 lb.

AIR SAFETY

Four Papers of Widely Differing Viewpoints Presented Before the R.Ae.S. in Full-day Symposium

FOR the first full-day discussion of the current season of Royal Aeronautical Society lectures, the subject chosen was Air Safety, and the meeting was held at the Institution of Civil Engineers last Saturday, March 5th. On this and the following pages we publish abstracts of the four papers presented. Mr. North is well known as the managing director of Boulton Paul Aircraft Ltd., and as a member of the Air Registration Board, whilst Dr. K. G. Bergin is the medical superintendent of B.O.A.C. Western Division and has about 2,500 hours logged as pilot.

Captain James has been chief pilot of B.E.A.C. since 1946 and, with over 10,000 hours on landplanes and flying boats as pilot, also holds engineer's, radio operator's and navigator's licences. Dr. G. E. Bell is head of the Operational Research Division of the Ministry of Civil Aviation.

AIRWORTHINESS AND SAFETY

By J. D. NORTH, F.R.Ae.S., M.I.Mech.E.

MR. NORTH'S paper was actually entitled *Some Aspects of the Relationship between Airworthiness and Safety*, and the aspects with which the author concerned himself were those with a "philosophic" root, in the broader sense of that somewhat overworked term.

In his introduction, the author stated that he viewed the problem of safety in aviation as fundamentally a problem of human behaviour, the human-controlled aircraft being, in effect, mechanically extended man. He then quoted Sir Charles Sherrington: "The cerebrum . . . comes . . . to be the organism *par excellence* for the readjustment and the perfecting of the nervous reactions of the animal as a whole, so as to improve and extend them. These adjustments . . . in higher animals, form the most potent internal condition for enabling the species to maintain and increase its dominance over the environment in which it is immersed."

The author postulated that, if we exclude the effect of the counter strategies of competition, an accident is a measure of the incompleteness of this dominance. What might be called the macro-mechanism of the extension determines the limit of the individual's power to select his self-centred environment and so the conditions to which he must, by the macro-mechanism, adjust himself. The micro-display determines the information from which the degree of uncertainty which attaches to alternative macro-actions is assessed. Within the limits of this uncertainty the risk is a matter of choice.

[We take it that Mr. North uses the term macro-mechanism to differentiate between the "mechanical" mechanism and the "animal" mechanism.—ED.]

This freedom of choice can, and (the author believed) does, cause the realized accident rate to regress towards the currently acceptable risk rate. This currently acceptable rate is essentially unstable (divergent) in its long-term trends unless influenced by external competition (i.e., comparative standards); this long-term instability is, in effect, a relaxation phenomenon.

It is this (freedom of choice within the defined limits of uncertainty) which, the author went on to suggest, accounts for the remarkable stability of road accidents under the influence of much safety propaganda. The latter corrects the drifting towards greater risk, but cannot influence the individual to reduce the risk-increment associated with his behaviour, since he takes those risks which he is prepared to accept. Although there is undoubtedly a great variation in individual behaviour, the size of the population is sufficient to maintain its inherent constitution approximately uniform.

It has been observed that removal of obstacles at dangerous corners does not, in many cases, materially affect the accident rate. Obstacles which prevent this voluntary compensation (e.g., islands) have a distinct safety value.

For these reasons, Mr. North deemed it quite unreasonable to expect to relate any qualities of an aircraft directly to the risk of accident unless the aircraft were of such a character that no environmental choice could influence its safety. It could, however, be said that these qualities will influence the economic value of the aircraft, since the environmental restriction imposed by an acceptable risk rate might be insufficient for economic existence. Since, however, these same qualities may equally influence the economic potential in quite different ways, "safety" qualities cannot be considered on their own and, indeed, never have been.

Value of Experience

Mr. North said he understood that both Keynes and Jeffreys hold that the proposition concerning the risk rate which must be considered in advance of *ad hoc* experience is to be judged on the basis of a reasonable degree of belief in the evidence. Our society is largely founded on the idea that people are generally capable of reasonable judgments (within the domain of their experience and ability). If they give reasons, they are wrong far more frequently than the judgment.

Tests prior to certification by an independent authority are intended to provide supplementary evidence, but many of them depend on expert judgment rather than measurement. The guiding belief that central authority by statutory rules can exercise a kind of vicarious judgment superior to that of the expert judgment of competent and honest persons appeared to the author to be unsupported by experience. This was not to be confused, however, with the many cases where expert judgment must be sacrificed to the necessities of co-ordination and the protection of society against the dishonest and incompetent.

The lecturer then went on to consider (i) the economic aspect, (ii) airworthiness and safety, and (iii) reliability, in a philosophico-algebraic form, and observed that, on the whole, we seem to have to depend largely on engineering intuition for interpretation of such evidence as we can provide in the early stages of special experience. This intuition, which depends much on the experience of one or more persons, might be greatly extended by appropriate investigation of operational experience. Reliability is provided in most engineering applications by large, even extravagant, margins between the "capacity" of the machine and the requirements of its environments. This margin is much narrower in aircraft and, hence, the problem is of much greater importance.

On the subject of the manner in which airworthiness is to be specified, Mr. North observed that, since it has been suggested that airworthiness is not something which in itself implies safety, but is merely an increase of the capacity of man's mechanical extension, it follows that any standard of capacity may be used to give various combinations of safety and environment. The process by which this division between caution and enterprise is controlled is, the lecturer believed, a regressive one, oscillating about the currently acceptable safety standards.

Since it is generally the practice for some central authority in a civilized community to exercise in many directions a control over the lives of the members of that community, it is not surprising that aviation should be no exception. This function of central authority is generally taken to be the protection of innocent members of society against the consequences of the

actions of incompetent, negligent or dishonest persons. In exercising this laudable function, it is difficult, if not impossible, suggested Mr. North, to avoid throwing out at least some healthy babies with the bath water.

The lecturer thought that the merits of the system, apart from the control of anti-social activities, appeared to be as follows:—

(1) The certification of the attributes of an aircraft by a disinterested and judicial third party.

(2) A degree of uniformity which might help to reveal the consequential effect of rules of practice and to simplify their modification if experience suggests that it is desirable.

(3) A central authority should have wider access to information, and consequently its judgment should be formed on more comprehensive data.

The demerits, suggested Mr. North, are these:—

(1) A forced uniformity may be, and frequently is, a handicap to evolutionary progress.

(2) The necessity of specifying, *in advance* of special experience, the boundary between the fit and the unfit, imposes a task of generalization from experience which is beyond human capacity. Inevitably, some unfit will be accepted and some fit rejected because of uncertainty; the latter will be in a large majority if the confidence level of fitness is to be high.

(3) There is grave danger of excessive generalization in the interests of what is called "administrative convenience." There are great disadvantages in excessive demands for calculations and tests where their value outweighs the benefits to be derived from them. There is, however, no merit in whole numbers, nor in expressing requirements "simply."

It is sufficient that they should be unambiguously interpretable by professional engineers.

(4) What is specified as a minimum in effect tends to become a maximum. The statement sometimes made, that responsibility rests on the aircraft constructor to provide more than the minimum, and that he should satisfy himself whether or not this is necessary, is unacceptable. If he is capable of, and can be trusted to, assess the requirements, there is no need for a minimum. Generalizations are disastrous when, although the interested parties *and the umpire*, agree that a regulation is inappropriate, it must be worked because it is a regulation. The salvation of airworthiness procedure has been, and will be, in the refusal of all parties to prefer the letter to the spirit.

Tradition and Control

No doubt, suggested the lecturer, the special reason for the extensive control of airworthiness is due to the forced evolution of aircraft under the influence of war and the threat of war. Seaworthiness has had some thousands of years of evolution under conditions which were competitive in the genetic sense. No doubt, the fact that seagoing preceded the invention of writing was an advantage in the early stages. Tradition in maritime affairs has been so tempered by this long struggle for survival that it has the utmost value. It would be interesting to hear the observations of the master of a fully rigged ship if he were instructed to set his sails in accord with some operational regulations, particularly if they were based on the frequency theory of probability.

However necessary, airworthiness and operational regulations may, by their very uniformity, create an untested tradition which in the interest of evolution ought, as a matter of principle, to be continually questioned. Unfortunately, if experience is circumscribed by restriction of variety, it is difficult for us to extricate ourselves from the strait-jacket.

The lecturer thought that confusion has sometimes arisen over the fact that aircraft found satisfactory in service do not conform to revised airworthiness requirements. He thought there was nothing surprising in an aircraft which did not conform with requirements having a satisfactory standard of airworthiness. The trouble is that it takes several years to come to the conclusion, hence the inevitable sacrifice of the possibly fit.

It was the lecturer's belief that the more reliance placed on *ad hoc* engineering judgment, the better. The complaint of "unfair" competition suggests that regulations should be regarded as something like bunkers on a golf course. It is curious, having regard to the universal cry of safety first, that unfair competition is not regarded as being too safe rather than insufficiently so.

Mr. North suggested that the best service which a world aviation authority could perform would be to investigate, record and analyse experience, a task in which they might, perhaps, be aided by applied economists, who are accustomed to struggle with the strange vagaries and equally inexplicable uniformities of human nature. He thought that there is much to be learnt from the technique of econometrics. The study of the micro-mechanism lies in the field of the psycho-physiology of mechanically extended man. Some progress has been made in this direction which, the lecturer believed, was worthy of more active pursuit.

THE PILOT'S VIEWPOINT

By CAPT. J. W. G. JAMES, O.B.E.

SOME of the factors which appeared to a pilot to have a bearing on the safety of airline flying were reviewed by Capt. James. He made it clear that pilots were not after "safety at all costs"—which would, in effect, mean the grounding of all aircraft—but sought rather the maximum safety compatible with the development of civil air transport as an efficient and economic business. Since accidents could not be done away with entirely while the human factor was pronounced and mechanical failures were possible, the best that could be achieved was to introduce the most effective measures to reduce the incidence of human and mechanical failures, whether they occurred separately or together.

Referring first to the aircraft, its layout and its handling characteristics, Capt. James said that the control cabin unfortunately provided plenty of material for criticism, particularly so far as British aircraft were concerned: he emphasized the necessity for good visibility at all times, a standard layout, comfort, a low noise factor, simplicity, and easy and natural accessibility to all vital controls. Too often, control cabins appeared to have been designed for (and tested in) fair weather. It was a major contribution to safe flying if the pilot was not hindered in adverse conditions by those discomforts and distractions which resulted from thoughtless design and unworkable aids.

Inefficiency in flight instruments, whether as a result of layout or type, became more apparent as the efficiency of the pilot (in instrument-flying) increased. Standard layouts would reduce fatigue and would play a considerable part in effecting a safe landing in poor conditions when the pilot was tired. On the question of fatigue, Capt. James thought that noise was a major problem, especially when caused by ill-fitting windows.

Crash-proof Tanks

While admitting the adequacy of the I.C.A.O. requirements for safety, the lecturer considered the design of fuel tanks to be an important consideration in saving life. He believed that crash-proof tanks should be installed in all passenger-carrying aircraft, and that the loss of payload involved would be more than compensated for by the improved safety record of the operator as expressed by the number of persons injured or killed. There was sufficient evidence to show that if aircraft could be prevented from burning there was a good chance of passengers escaping.

Individual opinions varied on the kind of handling characteristics required in aircraft, but it was on the approach, with the undercarriage and flaps lowered and with changing engine speed, that the good and bad characteristics were apparent. The first requirement throughout that period was that the pilot should be able to manage ailerons and elevators with one hand whilst operating throttles with the other. It was important, therefore, that the controls should be light and that response should be quick and effective.

On the subject of training, Capt. James believed that with the assistance of proved medical systems and the application of commonsense the right men could be chosen to become safe and efficient pilots. It was then left with the operating companies, by training, to mould that material for the job to be done. A sound technical knowledge in the pilot was imperative not only in those aspects which directly affected the operation of his aircraft, but also in wider (e.g., commercial) implications.

The speaker then made a number of suggestions for the training and checking of pilots which would assist in removing the undesirable "schoolboy" treatment. It was desirable, he said, to make any system of assessment as impersonal as possible to avoid discrimination and to ensure common standards and methods

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between instructors. Operational ability could be obtained only by experience, and the best pilots would be those who set out to learn continually and benefit by the mistakes they inevitably made.

Speaking of physical fitness, Capt. James mentioned the Ministry of Civil Aviation medical service, which was an examining body to record certain data and pronounce upon pilots a verdict of fit or unfit. Since every pilot was required to be examined every six months, and was consequently in danger of losing his job on each occasion, the speaker thought there was a case for the establishment by the airlines of a free medical service, the cost of which would be offset by a reduction in the turn-over of pilots and a lowering of the sickness rate, which would result in a higher yearly utilization and an increase in operating efficiency. Such a service would treat pilots as patients and disclose to no one their medical history without previous consent. By assisting pilots to keep fit a contribution would be made towards safety in flight.

Capt. James made some criticism of pilots' conditions of service in so far as flying hours and hours on duty were concerned. Although flying hours were a measure of experience, experience in one type of flying did not necessarily represent fitness for other types. Conditions on routes, and particularly the difference between long and short stages, presented a problem which made the existing official limitation of 125 hours every 30 days quite unrealistic, and it should be left to the pilot (protected by his associations) and the employer to decide the safe maximum flying or hours of duty according to types of aircraft, weather and experience on individual routes.

The lecturer believed strongly in the professional pride of pilots as indicated by self-imposed discipline and the knowledge that their contribution to civil aviation was not limited to flying aircraft. He looked forward to the day when no regulations and disciplinary codes would be necessary.

Examples of recommended procedures to ensure efficiency and discipline in airline flying, in which emphasis was laid on checking all drills and procedures against check cards, were next given by the speaker. Procedures during taxying, take-off, climb, descent, instrument flying, approach and landing, he said, all took into consideration the comfort of the passenger as well as the safety of the aircraft. With regard to flight-crew composition, he maintained that it was essential for each member to be trained individually to a high standard and also to be trained to operate in a team. Since it was generally impossible to maintain the same crew for any length of time, it was vitally important to have standard procedures and drills.

Standards of Operation

Route operational standards were thought by the lecturer to be necessary, and, whereas the Ministry were responsible for licensing aircraft and personnel, common standards of operation would not be forthcoming until every operator was required to produce proof of competency in operations. It was in the interests of safety and efficiency that all operators should study the I.C.A.O. publications on standards and recommended practices for operation of aircraft in scheduled public transport and, wherever possible, comply with them.

Emphasis was laid by Capt. James upon the need for high standards in instrument flying and navigation. The holding of the requisite licences was not enough in itself; constant practice under supervision was necessary. Standards of navigation and flying could fairly easily be assessed, but there remained what was, to his mind, the most important factor to be determined —ability of each pilot to know his own limitations when up against various day-to-day operating problems. Each phase of each operation had to be carefully assessed and decisions based upon training and instruction.

The value of imposing "weather minima" to ensure an adequate safety margin in operation was a debatable point among the pilots but the lecturer felt that the time when every pilot knew his own limitations and was capable of making decisions unassisted had not been reached, and it was necessary in the interests of safety to restrict the level of operations to an average. For efficient operation, however, that average had to be high.

Referring to route facilities, the lecturer compared the measures of standardization which had been achieved by I.C.A.O. in the technical and commercial fields, but he deplored the fact that standardization in navigational and approach procedures was far behind. It was therefore necessary for pilots to be efficient in several systems in order to be able to use any particular aid installed at airfields on the routes. Thus the pilot was still relying mainly on his fuel reserve in maintaining an adequate degree of safety.

Another vital requirement for safe and efficient operation was a high international standard of *en route* navigation and timekeeping. With high traffic density it was vital that aircraft should maintain accurately a predetermined track and maintain time schedules along the routes.

In the investigation of accidents Capt. James considered that good pilot-representation was essential and that they should be given opportunities to state their case and bring their experience to bear. The main object of accident investigation should be to determine the cause and take remedial action, and not to allocate blame.

In conclusion, the lecturer said that not only should an airline expect its pilots to take an active interest in their aircraft, but it should train and encourage them to take an interest in ground organization and, where necessary, to praise and criticize.

PHYSIOLOGICAL ASPECTS

By Dr. K. G. BERGIN, M.A., M.D., A.F.R.Ae.S.

INTRODUCING his paper on *The Physiological Aspects of Air Safety*, Dr. Bergin said that, however much importance was placed, and rightly, on such factors as aircraft structure and performance, meteorological aids, ground traffic control, and the many other details which were concerned with an aircraft's safety, the ultimate factor in this, as in almost every form of transport, was almost always the human one.

Although there might be, and usually were, contributory causes leading up to an accident, subsequent enquiries frequently recorded an error of judgment on the part of the pilot as being the final precipitating factor. Whether that judgment was right or wrong, just or unjust, was not for the lecturer to say. It did, however, underline the vital importance of the physical and mental state of the person in whose hands the control of the aircraft lay.

Dr. Bergin then discussed under several principal headings the physiological mechanism on which safety in flight depended.

Vision.—Two most important visual requirements for a pilot were good powers of convergence and fixation, and satisfactory power of accommodation. Convergence, with fixation, was the power of the eyes to converge on an object which was approaching, or being approached. When the distance between the object and the viewer was rapidly decreasing, as occurs in flying, flexible control of this power was of the greatest importance for the maintenance of one stereoscopic image.

These attributes of convergence, fixation, and accommodation were particularly important as an aircraft approached the ground to land, and as a means of assessing the position, speed, and change of direction of other aircraft in the air. Failure to judge such matters correctly was the cause of many mishaps, particularly in the vicinity of airfields.

The significance of these powers from the point of view of air safety was that they could be noticeably impaired by fatigue, inadequate oxygen, illness or other factors, the presence of any one of which in a pilot might create a potentially dangerous situation in the air, and must therefore be prevented at all times, if possible, when flying.

Night Vision.—Night vision was of great importance in flying. In this connection it must be appreciated that an entirely different set of organs on the retina were responsible for vision by night as opposed to vision by day. Vision by day was accomplished by means of "cones," so called because of their shape, whereas the "rods," the organs which operated by night, under conditions of minimum illumination, were thin and cylindrical.

Ability to see by night varied considerably in different individuals, this variation being due to the difference in response of the rods in different eyes to illuminations of low intensity; the reaction was a photochemical one, dependent among other factors on the production in the rods of a substance called "visual purple." An individual's night vision was adversely affected by a number of factors, including glare, lack of oxygen, smoking, alcohol, inadequate Vitamin A, and fatigue. Under starlight conditions it was reduced by as much as

five per cent at a height of only four thousand feet, due to the lowered pressure of atmospheric oxygen; and the subsequent decline at greater heights was proportionate. Night vision could be completely abolished by glare.

Hearing.—Another factor on which a pilot's efficient operation depended was accuracy of hearing. This was necessary for air-to-air and air-to-ground communication, as well as intercommunication within an aircraft. Accurate interpretation of auditory signals as used in various approach systems was essential if correct vital reactions were to be obtained. The constant bombardment of the ear by noise over a period of time, as experienced by an aviator, had been shown to cause a diminution in hearing acuity, known as aviation deafness.

A recent introduction, the electric audiometer, had revealed that persons who had been subjected to excessive noise over a long period might suffer from a considerable degree of deafness starting in the high tone range and, progressive by nature, ultimately including low tones as well. It was significant that the frequencies of inner marker beacons were 1,300 c.p.s. and fan markers 3,000 c.p.m.

The chief method of protection for aircrew was by means of suitably designed ear-pads and, secondly, the protection of the aircraft cabin as a whole by suitable insulation of the fuselage. The structure of pressure cabins materially assisted in this respect.

Investigations into the effect of jet noise on auditory acuity were proceeding at present, said the lecturer, and there was evidence to show that the effect of high-frequency noise on hearing was a problem which required constant attention, including special measures for the sound-proofing of cabins.

Oxygen.—The effect of oxygen-lack on aviators, although recognized to a certain degree, was not given the prominence it deserved until the late war. Many pilots would recall that for a number of years they had flown at certain heights without using oxygen and without any apparent deterioration in their physical or mental condition. Experimental evidence had, however, yielded irrefutable proof that relatively serious defects in a person's physiological mechanism did occur at lower heights than was at one time supposed.

Dr. Bergin recounted the various symptoms of oxygen-starvation, particularly with reference to its effects on eyesight. Then, continuing his review, he passed on to the question of equilibrium.

Dangerous Illusions

Equilibrium.—A sense of equilibrium was essential for safe flying, and, when in an aircraft, was conveyed to the pilot, first by his instruments, and secondly by his own sensations. A variety of impressions, visual, cerebral, and sensory, went to make up the general picture of a person's attitude in space, and if all these senses were working normally and vision was unimpaired an accurate estimate could be made. In flying, however, acceleration forces, effects of gravity and other factors produced false impressions by stimulation of these organs, and many illusions as to position could be produced.

Three important illusions which might occur in flying by night were dangerous by reason of the fact that false impressions of the movements of other aircraft might be given. They were as follows:—

(1) The auto-kinetic illusion, a visual one, consisting of the apparent movement of an object, such as a light, when fixated against a uniform dark background, other visual aids being absent. There was usually a short delay before its onset and the average duration of each phase was about ten seconds; it was experienced at some time by all normal persons.

(2) The oculo-gyral illusion, caused by a combination of visual and non-visual factors, namely, conflicting impulses received from the eye and semi-circular canals respectively. It consisted of the apparent movement of objects resulting from stimulation of the semi-circular canals following angular acceleration. Thus a stationary object appeared to move in a direction opposite to that of rotation.

(3) The oculo-gravic illusion, caused by a conflict of impressions between the eye and the otolith organ. It consisted of the apparent displacement of an object in space as a result of stimulation of the otolith organs by acceleration. Experiments conducted with a fixed light in an aircraft in complete darkness, observed under different degrees of acceleration, indicated that such sensations of motion and displacement of the light might occur at any time between 10 deg and 60 deg of bank, and increased with increasing bank. They always occurred during banks of 40 deg or more.

The illusions described were very little reduced by habituation, which made them all the more dangerous. Their occurrence might be largely prevented or cut short by several methods. First, the presence of lights in different vertical and horizontal planes was almost completely successful in abolishing the condition. Thus, when only the tail light of an aircraft was visible, auto-kinesis might occur, but, if lights in different locations, such as wing tips, nose and tail, were used, the condition was abolished.

Secondly, the interruption of vision would eliminate the condition and for this reason flashing lights were to be preferred to steady ones. Alternatively, the pilot might interrupt steady fixation by blinking. Thirdly, localization by means of other lights on the ground prevented the onset of the condition. Lastly, the fixation on some other point such as a windshield frame or canopy helped in reducing the intensity of the illusion.

A pilot's training taught him to subordinate these powerful impulses and rely entirely on his instruments, but a pilot who was suffering from fatigue, lack of oxygen, or adverse psychological disturbances, might find that he was obeying his impulses rather than his training.

Fatigue.—The signs and symptoms of advanced fatigue were self-evident, the early stages not so. Factors producing fatigue were length of individual flights, numbers of landings and take-offs, and type of aircraft. Weather was also a most important factor. Fear and apprehension were also high on the list and, in addition, glare, noise, vibration, insufficient oxygen or inadequate circulation of air all acted adversely on a person's state of physical fitness which in turn led to fatigue.

Every effort should be made to avoid the factors which contributed to fatigue by such means as adequate rest and relaxation for crews in between and during flights, suitable diet, properly timed, and the maintenance of the nearest approach to normal living conditions within the aircraft by maintenance of correct temperature, ventilation, humidity, and oxygen requirements in the cabin.

The provision of flying aids aimed at reducing other fatiguing factors. The introduction of the automatic pilot was an important advance in this respect, but it was for consideration how much automaticity of control was desirable from a psychological point of view.

Diet and Alcohol.—Extensive investigation during the war revealed that a normal, well-balanced diet was adequate for the needs of flying personnel. The effects of alcohol on man were so well known, said Dr. Bergin, as not to warrant further discussion except to say that its indiscriminate consumption by aircrew when on flying duty was only mentioned to be condemned, as representing a grave hazard in flying operations.

Comfort and Convenience

Turning from the man to the machine, the lecturer said that the closest co-operation between designers, operators, and medical advisers should take place at the very earliest stages in an aircraft's life, if satisfactory operating conditions were to be obtained.

Seats should be designed in conjunction with the advice of persons skilled in the application of anthropometry, with ample individual adjustment for variations in build, and particular care taken with such problems as correct support for the lower part of the back, taking into account the fact that the "lumbar curve" was very much greater than was generally imagined.

In windshield design, the first aim of an aeronautical designer was to approach as near to aerodynamic perfection as possible, but this was not always compatible with adequate visibility for the pilot The windshield must be so arranged that neither in design nor in material did its use entail muscular or ocular strain on the part of the pilot, which could quickly produce fatigue. The best angle of visibility for comfort and efficiency was about 15 deg from the horizontal.

Great strides had been made in recent years with regard to cockpit and instrument layout. If eye fatigue was to be avoided, instruments should be at such a distance that the normally seated pilot did not have constantly to use his power of accommodation in order to focus on his instruments. If he was forced to accommodate frequently, he would become fatigued and readings would become blurred and indistinct. The optimum distance was between 23in and 27in.

Two important features of controls to which insufficient constructive thought had been given were, first, that of their being recognizable by touch alone and, secondly, of their being reachable in all positions which the pilot was likely to assume in flight. Shapes for various controls were to a large extent standardized by S.B.A.C. practice, but could, in the opinion of many, still be bettered.

Dr. Bergin touched on the selection of suitable personnel for flying duties. For

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many years the selection of aircrew was based largely on the result of physical examinations only, and if certain physiological standards were attained a person was considered fit to fly. It had been appreciated for some time, however, that this was not the whole picture, and a person presenting all the necessary physical characteristics might be quite unsuitable for flying duties on account of psychological, temperamental, or personality traits, which, although not manifest under normal conditions of flight, might reveal themselves at times of stress or emergency with unfortunate results. Experience had shown that certain undesirable features should preclude acceptance of candidates for these duties. Thus, a previous familial or personal history of nervous breakdown, depressive state, or indication of psychological disorders should be investigated with particular care. By elimination at this stage much trouble in the future might be prevented. While such a statement was difficult as yet to prove by statistics there was little doubt that a number of accidents could have been avoided if more strict attention had been paid to preselective measures in the past.

TRAFFIC CONTROL RESEARCH

By G. E. Bell, M.Sc., Ph.D.

WITH the return of British civil aviation to normal operating conditions after the war it was found that several problems which had previously given little cause for concern had become acute. More especially, increased traffic, particularly in IFR conditions, and certain indirect consequences of the greater size and weights of aircraft, had created greater congestion around major airports. It therefore became urgently desirable to establish an effective system of close air-traffic control to ensure safety and rapid movement. The Ministry of Civil Aviation immediately gave much attention to this problem, but at once found itself in serious difficulties on account of the scarcity of sufficiently precise knowledge of the traffic and the traffic problem. Sir Conrad Collier, who was then Controller of Technical and Operational Services, succeeded in 1947 in establishing a small operational research section which began in the autumn of that year to obtain the necessary data.

It was the main results of these researches that formed the subject of Dr. Bell's lecture. Quoting the I.C.A.O. definition, he said that air-traffic control was concerned with the safe and expeditious flow of air traffic, from which it was obvious that studies connected with it should not be restricted to a narrow field. While it was concerned with long-distance navigation, other factors to be considered were the layout of airport runways, taxying tracks, and aprons, and the provision of adequate communications. Experimental investigations, said Dr. Bell, had included time- and motion-studies of take-off and landing, study of air-to-ground communications and an analysis of the traffic and traffic pattern in South-Eastern England.

Observers at the main airports had recorded the time required to carry out various operations on the ground and in the air. From these observations the most striking feature in the landing procedure was the variable nature of the approach time, as shown by observations at London and Northolt Airports. Approach time was the phase between an aircraft being given "No. 1 to land" and then being given "Clear to land," during which it moved from the stack to the appropriate point on the landing aid. At London Airport the average was found to be about seven minutes and at Northolt six minutes, yet an appreciable number of aircraft at both airports required over 15 min for this phase of the landing sequence.

Delays in landing were found to be almost always due to other aircraft landing ahead, and at London Airport in August last year, under I.F.R., about 40 per cent of arriving aircraft were held for an average time of rather less than 10 min, corresponding to a delay of rather over 3½ min if averaged over all aircraft. Take-off delays were usually due to aircraft waiting for others to land, but the average of all aircraft was only a little over 2 min, and on the delayed aircraft 5 min. At Northolt 65 per cent of the arriving aircraft were held either at the airport or at the entrance to the Metropolitan Control Zone for an average time of 16½ min, corresponding to rather more than 10½ min for all aircraft. Taxying speeds of four-engined and large twin-engined aircraft were found to average from start to stop about 20 m.p.h. over distances of 1,200 yd and the uniform "cruising" speed was in the region of 30-35 m.p.h.

Work on the utilization of communication channels was far from complete, said Dr. Bell, but under V.F.R. it appeared that communication took place between the ground and the aircraft for an aggregate time of about 60 sec while the aircraft was under local control for either take-off or landing. Under I.F.R., aircraft taking off were in communication with local control for about 80 sec and when landing for about 100 sec. These times represented about six separate communications, rather more under I.F.R. than V.F.R. and rather more during landing than take-off.

Position Determination

Dealing with navigation problems, the speaker said that an effective positive control system demanded that controllers should have a sufficiently accurate knowledge of the present position of all aircraft for which they were responsible and know their tracks and speeds well enough to estimate their future positions, while satisfactory height-keeping was an essential to the use of altitude separation as a means of ensuring safety. In practice, aircraft were supposed to report their position at certain times.

A study of various aspects of short-range navigation had been made possible by the provision at London Airport of long-range precision radar equipment (M.E.W.), with a maximum range of some 50 to 60 miles for aircraft at an altitude of 3,000ft.

Basic plan positions of the aircraft were recorded by cine camera. The study of traffic behaviour had proved extraordinarily difficult, for whereas a total of over 600 tracks were recorded under I.F.R. it had been possible, for various reasons, to analyse only about one-third. The sample was manifestly deficient in the traffic of charter operators, since their main base of operations at Croydon was within an area most affected by permanent echoes. Within these limitations, however, a number of useful figures relating to flights under I.F.R. had been obtained.

The lecturer then referred to the accuracy of entrance to or exit from the Metropolitan Control Zone and revealed that from a sample of 101 inbound and 132 outbound scheduled aircraft, 71 per cent of the inbound and 80 per cent of the outbound aircraft had passed within two nautical miles of the appropriate beacons, while two per cent of the inbound and four per cent of the outbound traffic passed at minimum distances greater than five nautical miles, the mean minimum distance being 1.6 nautical miles for inbound and 1.2 for outbound aircraft.

As to the accuracy of estimated time of arrival at the beacons, there had been poor ancilliary information, but there were no indications of a tendency to be early or late and the standard deviation was 3½ min. There appeared to be no correlation between the accuracy of E.T.A. and the time at which they were passed. At one extreme the E.T.A. passed 65 min in advance was in error by only one minute, while at the other the E.T.A. passed only 5 min in advance was in error by 6 min, the aircraft having, in fact, already passed the beacon when it reported its E.T.A. as 5 min ahead. In a few cases it was possible to check aircraft position reports against the actual position as known from the M.E.W., and this limited sample, mostly relating to outbound aircraft at coastal points, gave a mean error of about 5½ nautical miles, although errors of nine miles or more were observed on five occasions and an error of 26 miles on one occasion.

Many of the problems associated with civil air operations are essentially problems of congestion and delays which appear in several contexts, notably in connection with utilization of runways and of communication channels. Dr. Bell proceeded to describe, by means of equations and certain simplified assumptions, the manner in which theoretical studies had been made of these problems. Although, he said, these theoretical considerations threw light on the instance of degrees of congestion and of delays they related only to the average results "in the long run" and told nothing about the state of affairs for relatively short periods. It was obvious, however, that congestion, whether arising from chance or from some specific cause (e.g., technical failure) tended to be persistent.

Simulator experiments showed that the disturbance occasioned by a casual stack of eight aircraft was likely to be still felt after 20 or 30 had been landed, and, in fact, there was a few per cent chance that there would have been no appreciable improvement. Such factors, Dr. Bell said, suggested that it would be useful to try to forecast the likely state of airport congestion as far ahead as possible in order that the situation might be eased and delays reduced by some form of planned diversion or by flow control. Experiments to this end were in progress.

Battle of Britain House

New Youth-Service Training Centre

IT was in November, 1946, that a public appeal was launched with the object of raising £10,000 with which to purchase a large house at Ducks Hill Road, Northwood, Middlesex. The intention was to equip and open it as a youth centre in memory of pilots who fought in the Battle of Britain.

In spite of the fact that the appeal had to be restricted to the locality there was a generous response and something like a third of the necessary total was raised. The Middlesex County Council were then approach and consented to buy the house itself, while the sum raised by the Appeal Committee was handed over to be used for its equipment.

At a double ceremony on March 1st the house was opened by County Alderman Mrs. L. R. Ithell, Vice-Chairman of Middlesex County Council, deputizing for County Alderman W. J. Irving, M.P., while Air Chief Marshal Sir James M. Robb (Commander-in-Chief of the Air Forces of Western Europe and a former A.O.C.-in-C. of Fighter Command) unveiled the memorial tablet.

Mrs. Ithell spoke of the value of youth centres and of the training of youth-club leaders, in which, at this new centre, the University of London was to co-operate.

The Air Chief Marshal thanked those who had made the purchase possible. The original idea, he said, had come from Mr. Hunt, who was then a flight lieutenant in the Intelligence Section of No. 11 Group, Fighter Command, and who had been supported by A.V-M. S. M. McDonald, A.O.C. No. 11 Group at that time. The Appeal Committee, which was subsequently formed under the chairmanship of Mr. L. F. A. Fogarty, J.P., consisted of four local residents and four serving officers from No. 11 Group. Thanks were due to King's College, Cambridge, the previous owners of the house, for their generosity in reducing the price to a minimum and, in addition, making a cash donation of £500.

In the course of his speech, Sir James referred to A.V-M. S. F. Vincent, A.O.C. No. 11 Group, recalling that he was a fighter pilot of the first world war. Other past and present senior officers of Fighter Command who were at the ceremony included Air Marshal Sir William Elliott, A.O.C.-in-C. since 1947, and A.V-M. McDonald, A.O.C. No. 11 Group, 1946-48.

(Left to right) A. V-Ms. S. F. Vincent and S. M. McDonald, Air Marshal Sir William Elliott and Air Chief Marshal Sir James Robb examine the memorial tablet after the unveiling ceremony.

After paying appropriate tribute to all who had shared in the Battle of Britain, the Air Chief Marshal concluded by quoting the words of Marshal of the Royal Air Force Lord Tedder, when he unveiled the Rolls-Royce Battle of Britain Memorial Window: "Surely this memorial is a challenge as well as an inspiration," he had said. The Northwood memorial was then dedicated by the Rev. A. S. Giles, M.A., Chaplain of the Royal Air Force.

During the speeches it was suggested that R.A.F. and W.R.A.F. personnel might join those sponsored by the youth centres to take training courses at Battle of Britain House. Air Chief Marshal Robb told us later that he was most interested in the proposal, which he thought was a good idea.

PLUTONIUM PRODUCTION

WITH the announcement that plutonium has been produced in Britain for the first time comes a report from an American source that 100 lb of the substance is required for one atomic bomb. This statement, though its accuracy cannot be assessed, is one of the few direct references ever made to the possible weight of the charge.

Plutonium production at Hanford, Washington, is said to be at the rate of 20 lb a day, "enough for six bombs a month."

The bomb dropped on Hiroshima contained uranium, but the Nagasaki and Bikini bombs are believed to have contained plutonium.

SERVICES RUGBY—AN ARMY WIN

IN the second round of the Inter-Services Rugby Football Tournament at Twickenham last Saturday, the Army team, which included five internationals, overwhelmed that of the Navy in the first half, building up a 20-point lead. The final score, 23 points to 3, was made up of a goal, two dropped goals, a penalty goal and three tries to the Army, against a penalty goal by the Navy. The Army's success was due in the main to the great speed and dash of their forwards, who opened up and combined with the outsides whenever possible, though this is not to say that the backs were not equally effective. In contrast, the Navy were slow covering in defence and were frequently left with Army men over.

The Navy improved considerably in the second half and got a good share of the ball from set scrums, but, while saving a rout, they seldom looked like improving the balance of points.

Marshal of the Royal Air Force Lord Tedder, who is President of the Inter-Services Rugby Union, received Princess Elizabeth and the Duke of Edinburgh before the match, and the teams were presented to the Duke.

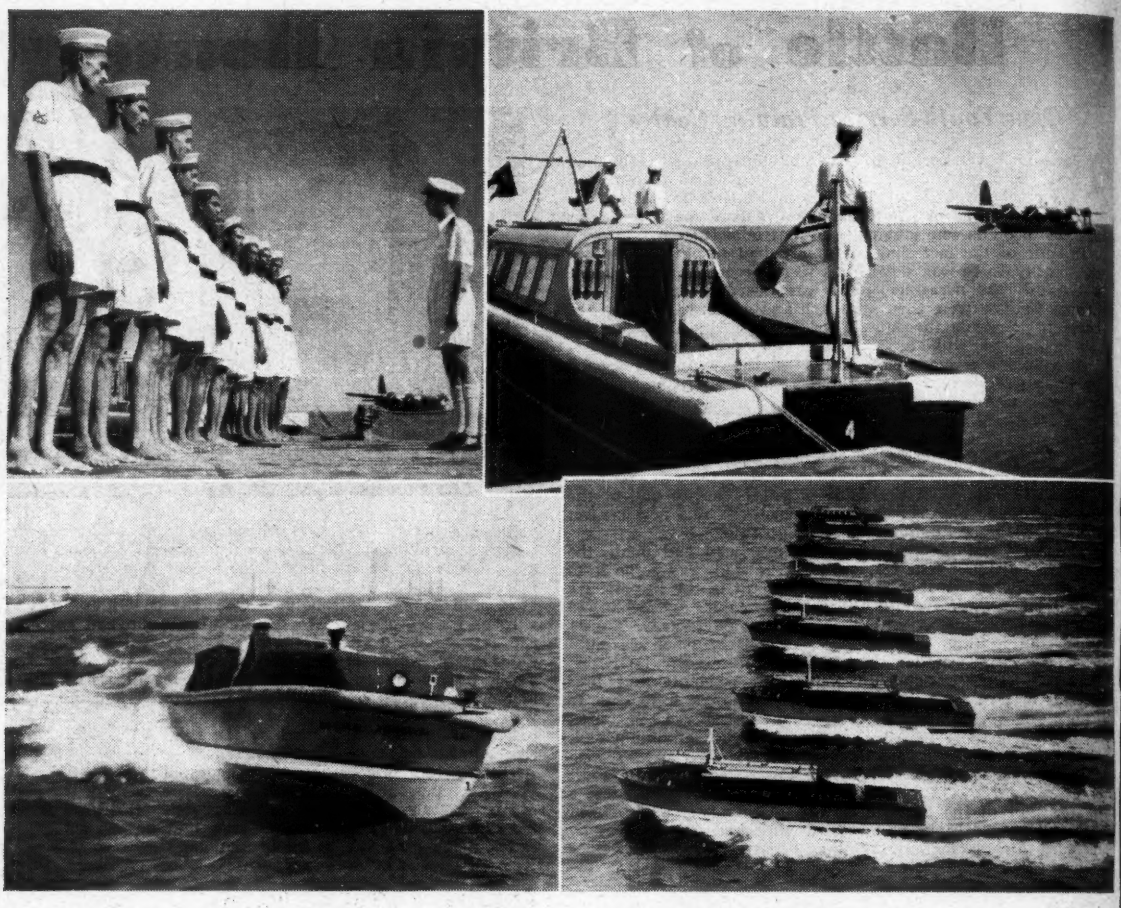
In the remaining match of the tournament, to be played on March 26th, the R.A.F. meet the Army, both teams having defeated the Navy (the R.A.F. beat the Navy on February 12th, 11—0 points). On the showing to date, the Army will start as strong favourites. Last year they won the game 15—8 points, but honours were even for the season.

AERODROME OWNERS MEET

AT the annual general meeting of the Aerodrome Owners' Association in the afternoon of February 28th, Councillor J. Fitzsimons of Manchester took office as chairman and Mr. A. M. Desoutter became vice-chairman for the current year. Members and their guests enjoyed dinner at Londonderry House the same evening.

Mr. G. S. Lindgren (Parliamentary Secretary to the Ministry of Civil Aviation), in responding to the toast of "Civil Aviation" proposed by Councillor Fitzsimons, referred to the helicopter as the vehicle of operation in the future. He warned owners that if an airfield was thought to be of value to the community then the Ministry of Civil Aviation would requisition it, but there was a responsibility upon the local authorities to look ahead and provide alighting sites for helicopters—in other words, rotorstations would be required in the city centres. To those who were the pioneers in aviation and who had established airfields but had subsequently lost them to the M.C.A. he offered the consolation of service to the community. He frankly admitted that the present facilities were due largely to the great foresight of the pioneers.

Mr. E. J. Rylands, chairman of the British Air Charter Association, congratulated Mr. H. G. Gillman, secretary of the Aerodrome Owners' Association and the British Air Charter Association, on receiving the O.B.E. The Charter companies, he said, had appreciated Lord Pakenham's reception of his Association's delegation to the M.C.A., as a result of which the Douglas Commission was appointed. In the light of the new regulations the charter companies would take every opportunity to provide the services required and still make a profit. The small airfields could still be relied upon to provide a service to the community and he referred to pleasure flights at Blackpool, where many members of the public paid for a local flight before flying on a scheduled service. He regarded every passenger as a potential salesman and he thought local pleasure flights should be encouraged.



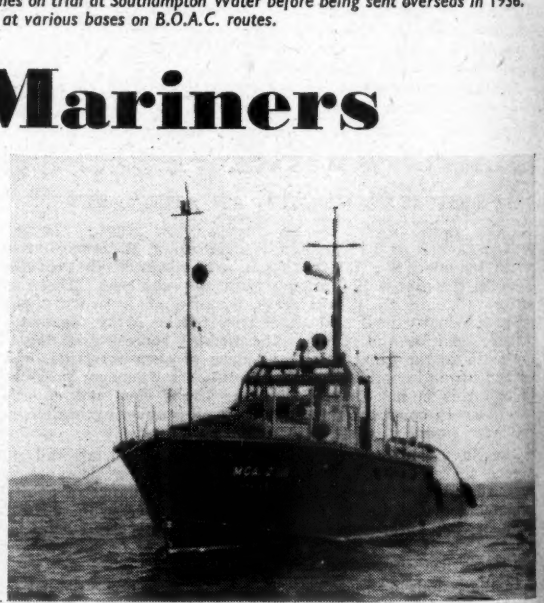
Top Left : As the passenger launch approaches or leaves the quay it is customary for B.O.A.C. marine-craft men to parade. These uniformed staff are employed at Karachi. Top right : A fully manned launch stands by to take passengers to the flying boat moored off the Korangi Creek base at Karachi. Bottom left : An auxiliary high-speed launch as used originally by Imperial Airways and now by B.O.A.C. for general duty work. Bottom right : The original fleet of control passenger launches on trial at Southampton Water before being sent overseas in 1936. Most of these boats are still operating at various bases on B.O.A.C. routes.

Airline Mariners

A Glimpse at B.O.A.C.'s Marine Craft Organization

UP to the withdrawal of the Short Hythe class flying-boats from the Australian route, British Overseas Airways Corporation was operating over 20,000 miles of flying-boat routes, on which 200 marine craft were manned by 700 trained staff at nearly 30 bases. Although the Corporation will continue to fly 11 Plymouth class flying-boats and 18 Solents on routes to the Middle East, Pakistan, India and the Far East to Japan, and also from the U.K. via the Nile Valley and Central Africa to Johannesburg, the marine equipment and staff will gradually be reduced.

Under the command of Mr. B. Smith, the B.O.A.C. Marine Superintendent and his deputy Mr. H. W. Scott, both of whom have worked with marine craft since Imperial Airways first flew the Empire flying boats in 1936, are some 30 coxswains, boatswains and marine officers. Two of them hold Master's Certificates and several have First or Second Mate's Certificates and all have served tours of duty in distant and isolated places overseas. It is normal for one or two of these officers to be based at each main



The latest type of air traffic control pinnace as used by the Ministry of Civil Aviation. These craft are equipped with radio.

station assisted by staff drawn from local labour and trained on the spot as launch crews, and for maintenance work. When the flying-boat routes were expanded during the last war a special recruiting drive was made for crews, and a Marine Training School was set up alongside the flying-boat training school at Vaaldam near Johannesburg. At home, women were recruited and were retained as coxswains until the closing of the war-time bases and the return of the B.O.A.C. staff from the fighting services.

The Corporation's fleet now consists of craft ranging from 60ft pinnaces to 16ft dinghies, for control, fire control, towing and for conveying passengers and freight to and from aircraft. Control launches are equipped with radio and crash equipment and are used to ensure that the alighting area is clear and that aircraft can alight or take off safely. In some cases the duties of fire prevention and control are combined but the fire controlling launches are generally 38ft ex-R.A.F. seaplane tenders fitted with twin diesel engines and a powerful fire-fighting pump. In addition, the alighting area must be kept free of plant growth and the launches are employed to keep the water clear of floating vegetation. Such control and fire fighting facilities would normally be the responsibility of the airport authority and not of the aircraft operator, but as is well known some local authorities are unwilling or unable to accept such responsibility and expenditure, and in those circumstances B.O.A.C. operates the equipment as agents for the Ministry of Civil Aviation. Pontoons, into which the flying boats are "warped" by power operated winches, have been installed at Southampton and Alexandria. As they are installed at other bases so the necessity for marine craft will diminish.

"A Girdle Round the Earth"

Boeing B-50, Using Flight Refuelling, Circumnavigates the Globe in 94 Hours

TO a Boeing B-50 strategic bomber of the United States Air Force goes the distinction of being the first aircraft to fly non-stop round the world. The distance covered —23,452 miles—is about 1,500 miles less than the earth's equatorial circumference.

Bearing the name *Lucky Lady II*, the B-50 left Fort Worth, Texas, at 11.21 a.m. on February 26th and touched down on the same runway at 9.21 a.m. on March 2nd (Central Standard times). She had been refuelled in flight by pairs of B-29 tankers over the Azores; Dharan in Saudi Arabia; the Philippines; and Hawaii. British equipment, supplied by Flight Refuelling, Ltd., was employed. Kelvin, Bottomley and Baird, Ltd., were responsible for a number of the refuelling instruments.

The announcement of the flight came as a complete surprise, secrecy having been rigidly maintained since a sister aircraft, attempting a similar flight, had come down in the sea on February 25th with an engine on fire, having covered 1,000 miles.

Under the command of Capt. James Gallagher, the crew of fourteen were greeted on return by Mr. Symington (Secretary for Air), General Vandenberg (Air Chief of Staff), General Lemay (Strategic Air Commander) and Major-General Ramey (Commander of the Eighth Air Force). Official pronouncements described the flight as "part of a continuing programme of flight-refuelling training flights, which will be flown to all parts of the world," and as proof that "the whole world is within range of America's atom-bomb sights."

Except that it was adapted for flight refuelling, the B-50 was standard and carried its armament of twelve 0.5in guns, but no ammunition or bombs. One Wing of these machines is already in service (*Lucky Lady* belonged to the 43rd Bomber Wing) but many of the 350 ordered remain to be delivered. A direct development of the B-29 Superfortress, the B-50 is described by its makers as being "75 per cent new in design." Structurally more efficient, it is distinguishable from its predecessor by the massive cowlings for Pratt and Whitney Wasp Major 36-cylinder engines and by a fin five feet taller than the B-29's. The all-out speed is about 400 m.p.h., and with normal fuel tankage a five-ton bomb load can be carried for 6,000 miles. For shorter ranges ten tons can be stowed.

The B-50's performance is especially interesting, because the type is the bomber counterpart of the Stratocruiser airliner, as ordered for B.O.A.C. Details of wind and weather during the flight are not available, but the average speeds for the various legs were: Fort Worth-Azores, 250 m.p.h.; Azores-Dharan, 270 m.p.h.; Dharan-Philippines, 242 m.p.h.; Philippines-Hawaii, 242 m.p.h.

After the completion of the historic flight it was announced that a B-29 tanker failed to return to its base in the Philippines after refuelling the B-50.

ANSONS FOR INDIA

SHOWN in the accompanying photograph is the first of twelve Avro Anson 18c trainers which are being supplied to the Indian government. The aircraft are intended for civil aircrew training and are equipped with up-to-date radio-navigational equipment, including V.H.F., H.F., and M.F. The accommodation layout provides for two pilots, radio operator, navigator and two pupils.

The Ansons have a striking black and yellow identification scheme.

An outstanding feature of the installation is the extensive system of communication, the control for which is decentralized by means of six radio panels, one at each crew station. This arrangement permits each crew member to select and mix together (with individual volume controls) the output of separate receivers, to select any of the transmitters and, in the case of the radio-operator, to use either W/T or R/T on the transmitter selected. In addition, intercommunication between crew members is provided as a continuous service, irrespective of any other service in use at the same time.

Mr. J. C. Nelson, of the Avro sales department, will shortly be flying the second of these machines out to Allahabad. During a three-week stay in India he will acquaint the Indian pilots with the characteristics of the aircraft.

BALLIOL CRASH INQUEST

VERDICTS of "accidental death" were returned at the inquest, held at Tettenhall on March 2nd, on Mr. R. Lindsay Neale and Mr. Peter Tisshaw, who were killed when (as reported in *Flight* of February 10th) a prototype Balliol 2 crashed near Wolverhampton on February 3rd.

Mr. J. D. North said that examination of the wreckage suggested that the windscreen might have been broken—possibly by a bird—and the cockpit enclosure torn away. The coroner said that no evidence of negligence had been found, and that the Balliol (which, according to an A.I.D. witness, had done less than 50 hours' flying) was completely serviceable.

Civil Aviation Debate

Criticism of Government Policy : Tudor IV for Freight Only

IN a debate on civil aviation in Committee of Supply on the Civil Estimates in the House of Commons on March 1st, speakers from both sides of the House criticized the British Airways' heavy losses, the Minister's appointment of a new Chairman for British European Airways, the inadequacy of air services in the U.K., the relationship of management and men in the Corporations and the failure of the Minister to make an announcement on Government support for flying clubs.

A. Cdre. A. V. HARVEY opened the debate with a declaration of disappointment that the nationalized Corporations had increased their financial losses this year by five per cent over the previous year. It required, he said, one employee of B.O.A.C. to work one year to carry five passengers at a cost of £345. A. Cdre. Harvey was alarmed by the announcement that Mr. Gerard d'Erlanger was resigning his post more or less at the request of the Minister. After paying a tribute to his work in face of many difficulties, he said it was indeed deplorable if Mr. d'Erlanger was leaving because he wanted to run the Corporation on a commercial basis.

The Air Commodore then referred to Lord Douglas, for whom he had great admiration as a war leader but whose appointment to the chairmanship of B.E.A.C. the Opposition could only regard as a political move. There was no doubt, he said, that the Corporations were lacking in men who knew and understood transportation and it was of no use to bring in people who had made names in other spheres. A. Cdre. Harvey protested that such a change should be made while Mr. J. V. Wood, the managing director of B.E.A., was on sick leave. He regretted also that staffs had been built up in the Corporations to be reduced subsequently with spasmodic dismissals every few months which resulted in the employees not knowing where they stood. He referred to the danger in operating from both Northolt and Heathrow, which were only a few miles apart, and said there was grave risk of collisions. Serious consideration should be given to allowing the charter companies to carry freight anywhere in the world on a scheduled service basis since he believed that it would be many years before the Corporations could provide such a service and he did not think that there was anything to be lost in the meantime.

He wanted to know whether the Corporations really had the freedom which was required to order and follow through the construction of their own aircraft. The report of the Hanbury-Williams Committee had not been published and it was his view that the Ministry of Civil Aviation should stay out of the business side of ordering aircraft, and preferably the Ministry of Supply as well. He asked also whether the House could have some information on rumours that B.O.A.C. was taking over B.S.A.A., and remarked that it may be right also to merge the Ministry of Civil Aviation into the Ministry of Transport as an important division in that Ministry.

London's Airport Pattern

MR. GEORGE LINDGREN, the Parliamentary Secretary to the Ministry of Civil Aviation, gave the total staff of the Ministry as 8,000, of which 6,300 were employed on out-stations. He apologized for being unable to make any report on support for the flying clubs as discussions were at present proceeding with the Treasury, but he promised a statement as early as possible. Referring to the airfield pattern for London he agreed with the criticism made by A. Cdre. Harvey that the proximity of the two airports made the use of Northolt a risky operation when London was operating at full capacity. With the further development of London Airport, however, Mr. Lindgren hoped that B.E.A.C. would use that airport when the Ambassadors came into operation in 1951-2 so that the M.C.A. could give up Northolt by the time the lease expired in 1955. If B.E.A. operations and maintenance activity were transferred to London Airport by 1951-2 it would permit simple connection between B.E.A.C. and B.O.A.C. services. Gatwick was to be derequisitioned by next September and Blackbushe by the end of 1950.

For charter operators who would be displaced from those two airports, Mr. Lindgren would offer Stanstead Airport, near Bishop's Stortford, which would be made also the diversionary airport for London, so allowing the Ministry to vacate Bovingdon as well. Fairlop was being protected under town planning to preserve its approaches, but it would not be developed until requirements made its use essential. Mr. Lindgren disclosed that 189 applications had been received from 44 companies since the Ministry's announcement to allow charter companies to operate as associates of B.E.A. on internal services.

While admitting that deficits in 1947-8 amounted to £11,000,000 and the anticipated deficit for 1948-9 was £9,000,000, Mr. Lindgren inferred that the target deficit of £5,500,000 for 1949-50 might also not be achieved. The basis of calculations had been changed in a rather unfortunate manner. Many factors had come into play which were beyond the control of the Corporations and which might affect the achievement of that target, and he mentioned the delay in aircraft deliveries and difficulties which had arisen in aircraft development.

The Parliamentary Secretary told the House of Lord Pakenham's decision to remove the Tudor IV permanently from passenger service. The latest investigation had not disclosed any probable cause of the loss of *Star Ariel* and in view of the previous disaster to *Star Tiger* the decision had been made reluctantly but in agreement with the chairman of B.S.A.A. Tudors would be used "after certain modifications" for carrying freight, in the first instance on the Berlin Air Lift. Questioned on the consequent risk to crews, Mr. Lindgren said they had the future of aviation at heart and were willing to take big risks.

Mr. Lindgren admitted that during the period of rapid expansion after the war there was a tendency for an accumulation of staff in the Corporations. Now that the services, routes and standards had been decided upon, adjustments had been made and in B.O.A.C. 5,000 people and in B.E.A. some 800 people had already been dismissed.

The B.E.A.C. Chairmanship

Dealing with the change of chairmanship of B.E.A., Mr. Lindgren said there was no personal disagreement between Lord Pakenham and Mr. Gerard d'Erlanger. The change of appointment was made because the Minister felt it would benefit the development of B.E.A. and civil aviation generally. No chairman of any organization could claim the right to perpetual reappointment, he said, and the fact that in this case a reappointment was not made did not mean there was criticism of the individual.

Later in the debate SIR PETER MACDONALD said that Air Marshals were not fitted by training, tradition or attitude of mind to deal with civil transportation problems and MR. COOPER urged that people in positions of responsibility in the Corporations must primarily have commercial experience. MR. GRANVILLE added an expression of his astonishment at the appointment and said that those who believed in the future of civil aviation read of the appointment with amazement, and he referred to the long fight in the House many years ago to take civil aviation away from Air Ministry control and the Air Ministry mind. That long fight had been of no avail, since we were now returning, he said, to something in the nature of Air Ministry control and influence, and he drew attention to the appointment of the Airport Commandant at Heathrow. Since they could not accept the Parliamentary Secretary's statement earlier in the afternoon, he asked that the Government should give a far more satisfactory and informative reason for the change in the appointment. We should not make an efficient business of civil aviation, he said, unless those who were in the organization created an efficient unit by their own work, and such people were not brought in at the top.

MR. LINDGREN declared that the recent decision to operate a Welsh service had been made after advice from the Welsh Advisory Council had been given to B.E.A. He denied, however, that there had been any question of direction and that there was no relationship between that incident and the change of chairmanship. He further deprecated suggestions of a political character about the appointment of Lord Douglas.

The Parliamentary Secretary gave the following dates of expected deliveries of aircraft for the Corporations. Canadairs, he said, were due in May, but as they were ahead of schedule, they might arrive in April, and they would be brought into operation in August or October. The Handley Page Hermes was expected in May and he hoped would be brought into service early in 1950. The D.H. Comet was expected in 1952. Delivery of the Bristol Brabazon I was expected in June and B.O.A.C. hoped for delivery of the Boeing Stratocruiser in July to operate early in 1950. The motion to reduce the vote for the Ministry of Civil Aviation by £100 was defeated by 243 to 97.

CORRESPONDENCE

The Editor does not hold himself responsible for the views expressed by correspondents. The names and addresses of the writers, not necessarily for publication, must in all cases accompany letters.

THE S.R.45

Not a Boat, but a Ship

LET us not belittle the S.R.45 140-ton air liner now under construction for B.S.A.A. by calling it a "flying boat." This revolutionary machine is definitely a "flying ship."

Secondly, we must coin a word to describe the home for such a monster. Coastal Command refer to "flying-boat bases" and B.O.A.C. call Berth 50 at Southampton a "marine airport." Why not "seadrome"?

London, W.1. SIMON WARRENDER.

[*"Seadrome" was the name used to describe the Armstrong "floating airstrips" proposed for the Atlantic before the war.*—ED.]

AIRCRAFT CARRIERS

Are They "Superfluous White Elephants"?

ARE aircraft carriers superfluous? This may seem a startling question when one considers the importance attached to the 45,000-ton and 60,000-ton carriers and to our own *Ark Royal* Class by the navies concerned.

But, I repeat, are these giants merely superfluous? What function can aircraft based on them perform that cannot be more efficiently carried out by land-based aircraft? What kind of protection to carrier-based bombers can the fleet fighters provide when opposed to the overwhelming numbers a land-based air force could put up against them? And what weight of bombs can a squadron of fleet bombers drop compared with a squadron of the already obsolescent Lincolns? What part, indeed, of the world is not within range of the American heavies based in America, Britain or their dependencies?

These, and other, reflections have sprung from reading that the brand new *H.M.A.S.* Sydney will carry only 24 aircraft—12 fighters and 12 light bombers!

It appears that both in Britain and in the United States responsible senior naval officers, at last realizing the impotence of the battleship against air attack, are now attempting to drag out the expensive existence of their ancient and indeed honourable Service by absorbing large numbers of men, scarce materials, and untold millions in the creation of these white elephants—or should it be "white whales"? Their usefulness in an atomic bomb war will be undoubtedly nil—nor will the Navy's pathetic experiments in avoiding the effects of such bombs by dispersal avail them when a shower of such bombs is directed at them—if indeed, of course, such bombs are wasted on such a secondary target. Even in a war from which atomic bombs are excluded, they will form nothing but scurrying helpless targets for the bombs of the strategic air forces, or for the even more deadly guided missiles. CHAIRBORNE.

Bournemouth, Hants.

S.O.S. MARKS THE SPOT

Another Suggestion for Automatic Radio Transmission of Crash Location

ALTHOUGH philosophically I suppose it may be stated that as long as aircraft fly, aircraft will crash, the acceptance of this should not prevent the continued efforts to make aircraft as safe as humanly possible. Reading your recent editorial on the B.S.A.A.C. Tudor crashes, I was struck by the terrible significance of an aircraft being lost at sea with no indication to searchers as to the precise location of the crash.

Knowing how difficult it is to sight small objects at sea in poor surface conditions—even from the air—it occurred to me that the provision of some emergency signalling apparatus might well be of great value.

With no specialized knowledge of the subject at all, it appears to me that there should be no particular difficulty in designing and building an automatic radio transmitter housed, complete with batteries, in a sealed container, either of sufficient natural buoyancy or with automatically inflatable buoyancy bags, which could be ejected from the aircraft and descend by its own parachute. If means were provided of ejecting the device at the instigation of an inertia crash switch (e.g., as used in the Graviner anti-fire system), the ejection being made either by mechanical spring or low-velocity cartridge, break-up of the aircraft in the air, as perhaps might happen in severe gust conditions, would ensure that the transmitter was thrown clear to send out its call. What sort of signal strength could be made a practicable proposition I have no idea, but surely it would not be impossible to give a range of perhaps 200 miles for 2 hours, thence decreasing as the batteries became weaker but still with an effective signalling life of perhaps 10 hours.

In the case of a crash at sea, whilst it may well be that the aircraft would sink, it is just possible that, by getting rescue to the scene with a minimum of delay, a life might be saved, and even the evidence of an ordinary passenger as to the crash is better in giving some indication of the cause than no evidence at all. It is, of course, the complete lack of known reason for these Star Class Tudor crashes that is stultifying in its effects.

The incorporation of an emergency signalling device such as I have suggested would, of course, be of equal service in the case of aircraft crashing in remote land areas. Perhaps some of your technically erudite readers could offer suggestions as to the construction of a suitable apparatus, or illustrate the fundamental difficulties involved, for it is only by ventilating the subject thoroughly that snags can be overcome or by-passed. CLAUDE ALDBURY.

London, W.1.

[*The above suggestion was received at the same time as a somewhat similar one, from Mr. G. S. Orchard, which we published on February 24th; space has not permitted its inclusion earlier.*—ED.]

AIRCRAFT VARIANTS

A Reader in Search of Information

I HAVE been preparing a very comprehensive survey of all aircraft variants used by the air forces of the British Empire during the recent war. I should be very glad to hear (c/o the Editor) from any of your readers who have knowledge of particular modifications made to standard aircraft—for example, unofficial "mods" made in the squadrons, such as the Tiger Moth modified to carry a stretcher case, as mentioned in *Flight* of February 10th. I should welcome a few details, e.g., the serial number of the aircraft concerned, if possible.

Oxford. G. R. SATCHLER.

MANNING THE R.A.F.

"Give us the Tools"

LIKE so many others, I have been reading with considerable interest the series of articles which are appearing in *Flight* concerning the R.A.F.'s recruiting drive and the arguments appertaining to it.

Might I be permitted to add yet a little more to the deluge of criticism, and express my consternation at failing to have found any comment on one very great deterrent to ex-tradesmen coming forward in answer to the national appeal.

My criticism is, apart from views already adequately expressed, that far too little attention is given to tradesmen's tools and equipment throughout the R.A.F. During the last war one heard with loud acclaim, "Give us the tools and we will finish the job." But what, may I ask, was actually given to the flight mechs. and fitters to do the job with? On this point I speak with experience, limited though it may be.

The tools we received were, in more cases than not, quite inadequate for the task in hand, especially when it came to working on machinery and equipment of American manufacture. The average fitter who possessed the magnificent R.A.F. range of tools under the nomenclature of "Fitter's Tool Kit," found work under such conditions extremely harrassing, to say the least. For anyone to possess anything like a decent kit of tools was almost unheard of in the R.A.F.

Whom, may I ask, of those employed by civilian firms could or would work with such inefficient and extremely ill-planned tools as we were expected to use in the "mob"? I doubt if any of our R.A.F. planners—technical side—have ever experienced working in very inaccessible places with the incorrect tool. But I am sure there are many thousands of ex-R.A.F. men who have had similar experiences countless times. I, for one, would never contemplate returning to such antiquity, and I am convinced that these sentiments are also shared by thousands more.

There is one way, in my opinion, in which this state of

Correspondence . . . . .

affairs could be overcome. Why not approach the man or woman who actually carries out the work and find out from them what is really needed. As is known by all, the "ranker" is never consulted as to what is required for any particular type of work which he or she is likely to encounter. This system, I am sure, would result in a much better application of tools and equipment to the actual work to be done.

London, W.11. D. CHISHOLM, Ex-Sgt. Fitter.

Ground Crews

PLEASE permit me to express my regret to your correspondent, Mr. F. A. S. Brown, for any hurt he may have suffered by the misinterpretation of my letter (*Flight*, January 27th), but I can assure him that it was not intended to accuse him of bias against the R.A.F.—rather do I appreciate the interest he has shown in trying to bring to light the grievances of R.A.F. personnel.

I did, and still do, contend, however, that Mr. Brown is biased against the ACH/GD, and consider his further letter more than substantiates my views in this respect.

If Mr. Brown cares to communicate with me personally, c/o the Editor, I will give him a complete answer to every query he raises in his letter (*Flight*, February 17th).

Newcastle-on-Tyne. ALEX. A. METCALF.

Men with a Grudge

YOU have deemed it your duty, in the past few weeks, to publish considerable correspondence dealing with the state of the Royal Air Force. You have, obviously, tried to obtain, to the best of your ability, a cross-section of opinion. So far as my recollection goes, you have printed letters from a distinguished (retired) Air Marshal, an N.C.O. (aircrew) serving in Transport Command and engaged in "Operation Plainfare," several ex-officers, and many ex-rankers, and so forth.

During all the ranting and clamour one point of the greatest importance may have been overlooked. This is, simply, that the individuals most concerned are not allowed to retaliate against the baiters and back-biters. I mean, of course, the tens of thousands of men who have made the Royal Air Force their career. They are debarred from corresponding with the Press on matters to do with the Service—in the same way that the Civil Service are debarred from making their views known. This is not a bad thing in itself, but it is rather riling for serving officers and men to remain silent while their Service is abused and often misrepresented to the world of aviation at large.

Apart from the distinguished Air Marshal, whose views were of the greatest interest, the majority of your correspondents seemed to me to be men with a grudge against the Service. I recall an ex-Halton boy who was not given a permanent commission—and, in his opinion, should obviously have been given one; several airmen whose knowledge of the Service seemed to be confined to those difficult and trying days soon after the start of demobilization, when the R.A.F. had to contract from its great war-time establishment to a sensible size, compatible with the length of the taxpayer's pocket; and several tired old ex-wing commanders who think they know more about Organization and Administration than the Air Member who heads that department at the Air Ministry.

I attach my card, but must remain,

London, W.1. SERVING OFFICER.

[*It is not, perhaps, strictly accurate to say that serving personnel are debarred from writing to the Press. They may do so provided they obtain permission; and this may involve submission of the letter through the "usual channels," which in our experience are often so slow that the subject loses its topicality.*—ED.]

THE NEW D.H. COMET

American "Disclosures"

From A. Cdre. Sir Frank Whittle, K.B.E., C.B., R.A.F. (Retd.).

WITH reference to the item about the De Havilland Comet on page 224 of your issue dated February 24th, 1949, I would like to make it quite clear that I have not disclosed any information about performance, seating capacity or general arrangement of the Comet to Milton W. Arnold or to anybody else not entitled to receive it by virtue of their official connection with the aircraft.

The figures mentioned, if derived from me at all, would presumably be based on my opinions about the future possibilities of jet aircraft in general. F. WHITTLE.

Rugby.

[*We did not accept that Sir Frank had disclosed this information, but the American article was certainly so worded as to convey that impression.*—ED.]

PRENTICE BY NIGHT

Constructors' Reply to Some Detail Criticisms

IN the article "Prentice by Night," published in your February 10th issue various criticisms were made, and I should like to take this opportunity of replying to them. The three points specifically mentioned have all been corrected, and the present position is as follows:

(1) *Windscreen wiper.*—A satisfactory lightweight pneumatic wiper has now been successfully developed following close co-operation between the Dunlop Rubber Co. and Percival Aircraft, Ltd., and delivery of wipers is expected early in March; the original wiper was installed on the second prototype aircraft T.V.166 and has been under constant development. The only windscreen wipers which the M.o.S. or the industry at large could offer were prohibitive with regard to weight and current consumption.

(2) *Cockpit coaming.*—Modification action was initiated as far back as January, 1948, to cut back the coaming to introduce a modified crash-pad, and modification kits will shortly be issued to the Service. It should be appreciated that it takes some considerable time for a modification to be actually embodied on Service aircraft from the date of inception.

(3) *Foot-rest.*—A Percival proposal for a foot-rest was incorporated in the first production aircraft at the final conference in February, 1948, and a further set was sent to the R.A.F. for pilots' comments. It was only recently that we have been able to receive a decision from the Ministry regarding their agreement on the incorporation of this feature.

Luton, Beds. Y. GALITZINE,
Public Relations Officer, Percival Aircraft, Ltd.

FORTHCOMING EVENTS

Mar. 10th.—R.Ae.S. (Isle of Wight): Lecture by N. E. Rowe, C.B.E., D.I.C., B.Sc., F.R.Ae.S.
Mar. 10th.—Timber Development Association: "Modern Adhesives—Their Present and Future Application." D. A. Hubbard.
Mar. 11th.—R.Ae.S. (Portsmouth): "The 'Debunking' of Aeronautical Sciences," C. G. Grey, F.M.R.Ae.S.
Mar. 12th.—R.A.F. Bomber Command: First Reunion, Albert Hall.
Mar. 12th.—British Interplanetary Society: "Review of Progress in Astronautics Since the War." A. V. Cleaver.
Mar. 12th.—The Science Museum: "Gliding and Soaring Flight," G. Tilghman Richards, M.I.Mech.E., F.R.Ae.S.
Mar. 15th.—Aero Golfing Society: Match with R.A.F. Golfing Society. Royal Wimbledon Course.
Mar. 15th.—Londonderry House: Films, "Hollandia Campaign in Dutch New Guinea, 1944," W. Courtenay, M.M.
Mar. 16th.—R.Ae.S. (Brough): "Supersonic Flight," J. R. Ewans, B.Sc., D.I.C., A.F.R.Ae.S.
Mar. 16th.—R.Ae.S. (Hatfield): Annual General Meeting.
Mar 17th.—Royal Aeronautical Society: "The Design of Propellers," J. Mullin, B.Sc. (Eng.), A.F.R.Ae.S., and C. G. I. Gardiner.
Mar. 17th.—R.Ae.S. (Coventry): "The Automatic Pilot," A. I. O. Davies.
Mar. 17th.—R.Ae.S. (Manchester): "Personal Experiences of Early Aerodynamic Research," Prof. Sir B. Melvill Jones, C.B.E., A.F.C., F.R.S., Hon. F.I.AE.S., F.R.Ae.S.
Mar. 18th.—Institute of Navigation: "The Use of Radar Beacons," K. A. B. Gilfillan, M.B.E.
Mar. 22nd.—R.Ae.S. (Belfast): "Civil Aviation—Present and Future," P. G. Masefield, M.A., F.R.Ae.S., G.I.Mech.E.
Mar. 22nd.—Royal Aeronautical Society: Joint Meeting with the Airport Engineering Division of Civil Engineers.
Mar. 23rd.—Royal Aero Club: Annual General Meeting.
Mar. 23rd.—R.Ae.S. (Luton): Members' Discussion Evening
Mar. 23rd.—R.Ae.S. (Leicester): Films.
Mar. 23rd.—R.Ae.S. (Graduates' and Students' Section): Annual General Meeting.
Mar. 24th.—R.Ae.S. (Isle of Wight): Brains Trust.
Mar. 24th.—The Science Museum: "The Aircraft Collection," Mr. G. Tilghman Richards, M.I.Mech.E., F.R.Ae.S.
Mar. 26th.—Edinburgh Flying Club: "At Home," Macmerry, Edinburgh.
Mar. 26th.—Rugby Football, Twickenham. The Army *versus* Royal Air Force.
Mar. 26th.—Helicopter Association of Gt. Britain: Paper by Air-Cdre. W. H. Primrose, C.B.E., D.F.C.
Mar. 30th.—R.Ae.S. (Weybridge): Junior Prize Lecture.
Mar. 30th.—R.Ae.S. (Gloucester and Cheltenhem): "Radar Aids in Aeronautics," Dr. S. F. Evans, M.Sc., Ph.D. *At Cheltenham.*
Mar. 30th.—Royal Air Force Club: Annual General Meeting.
Mar. 31st.—Royal Aeronautical Society: "Repeated Loading of Aircraft Structures," Dr. P. B. Walker, M.A., F.R.Ae.S.
Mar. 31st.—R.F.C. and R.N.A.S. Reunion, Londonderry House, W.1.
April 2nd.—British Interplanetary Society: "Astronautics and Astronomy," M. W. Ovenden, B.Sc., F.R.A.S.
April 4th.—R.Ae.S. (Derby) "Rocket Propulsion and Inter-Planetary Flight," A. V. Cleaver, A.R.Ae.S.
April 5th.—R.Ae.S. (Belfast): Evening of films by William Courtenay, M.M.

SERVICE AVIATION

Royal Air Force and Naval Aviation News and Announcements

DISTINCTIVE: The split tail-pipe of the Hawker P.1040, one outlet of which is shown to advantage in this view, contributes not only to the aircraft's "different" appearance but to its range.

A New Air Reserve

THE formation of a new air branch of the auxiliary and reserve forces has been announced. To be known as the Auxiliary Air Observation Post Force, it will provide twenty flights, each of five Auster 6s, to fly and observe for the artillery units of the Territorial Army. The new force is at present being organized by Reserve Command, and its formation is expected to be complete by the end of this year; the first units are, in fact, already forming at Colerne, near Chippenham.

Like the regular A.O.P. units, the force will be under R.A.F. control, although its tactical use will be the responsibility of the Army. Aircraft will be flown by Territorial Army pilots, and serviced by members of the R.Aux.A.F. Recruiting for pilots will at first be directed at ex-A.O.P. pilots, and suitable volunteers from T.A. Artillery units will later be accepted. Ground crews will be qualified ex-Servicemen, or those with comparable experience.

There will be five squadron headquarters, each with a R.Aux.A.F. mobile servicing section attached. The twenty flights will be mainly of the observation only, or "A," type, but there will also be a number of photographic and observation type "B" flights. Details of development are given below:—

Northern Reserve: Four flights: one at Yeadon (Leeds); one at Desford (Leicester); one at Ouston (Newcastle); and one (type "B"), together with a mobile servicing section, with No. 664 Squadron H.Q. at Hucknall, Nottingham. *Southern Reserve:* Three flights: one at Andover and two, together with mobile servicing station, with No. 662 Squadron H.Q. at Colerne. (These are the units already forming.) *Eastern Reserve—including London area:* five flights, one at Henlow; and two (including one type "B"), together with a mobile servicing section, with No. 662 Squadron H.Q. at Kenley, Surrey. *West and Welsh Reserve:* Five flights: one at Llandow (Cardiff); one at Ternhill (Shrewsbury), one at Ringway (Manchester); and two (including one type "B"), together with a mobile servicing section, with No. 663 Squadron H.Q. at Woodvale, near Liverpol and Blackpool. *Scottish Reserve:* Three flights: one at Turnhouse; one at Dyce, Aberdeen; and one, together with a mobile servicing section, with No. 666 Squadron H.Q. at Perth.

Naval Trophy Awarded

THE Senior Naval Test Pilot, Lt.-Cdr. (A.) E. M. Brown, has been awarded the Boyd Trophy for his "outstanding skill and enterprise" during development trials of a modified Vampire, strengthened for landing on a flexible deck without the use of an undercarriage. Before the present trials on the carrier H.M.S. *Warrior* were undertaken, preliminary tests were made at Farnborough. Models were used at first, and a weighted glider was landed on a flexible surface. After strength-tests of the airframe involving static drops, the Vampire finally made its first dummy deck-landing at Farnborough.

The Boyd Trophy is a silver model of a Swordfish, presented by the Fairey Aviation Company, and is awarded annually to the naval pilot or aircrew who, in the opinion of the Flag Officer Air (Home), achieves the finest feat in naval aviation. It will be presented to Lt.-Cdr. Brown at Lee-on-Solent today, March 10th. He received the O.B.E. (Military Division) for making the first deck landings and take-offs of a jet aircraft (the prototype Sea Vampire) in 1945, and was earlier awarded the D.S.C. in 1942 for protecting a convoy during heavy and sustained air attacks.

Some of the main points arising from the flexible-deck trials, which touch on many aspects of carrier operations and naval aircraft design, were mentioned in last week's issue of *Flight*. If, as seems probable, the trials are completely successful, catapulting of naval aircraft will become almost the only method of take-off. Future fighters should, by the absence of undercarriages, gain something like 5 per cent of their all-up weight as extra fuel or ammunition capacity. For landing-on, it seems that external tanks

GONE FOR A SOLDIER: As Honorary Colonel of 490 Mixed Heavy A.A. Battery (T.A.), Marshal of the R.A.F. Lord Tedder appeared in unfamiliar khaki when he visited the unit's headquarters at Finchley on February. 21st.

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would have to be jettisoned, and some form of automatic flap-retraction provided at the moment of touch-down to prevent damage.

R.A.F. Award

FOR a display of "outstanding courage and devotion to duty" on October 13th, 1944, W/O. Donald John Edward Hicks has been awarded the George Medal. A King's Commendation for brave conduct was awarded to him in 1945, but since then further details of his action have become available. W/O. Hicks was the flight engineer of a Catalina of the South Pacific Survey Flight, which was established in October, 1944, to survey part of an air route from Montreal to Australia, via Honolulu, Fiji, and Auckland.

On the date in question the Catalina was moored, unmanned, off Clipperton Island, when a hurricane approached. The preliminary squall blew the aircraft towards the island, and while it was precariously held by one anchor, which caught in a coral reef, W/O. Hicks rowed 50yd in a dinghy, boarded the aircraft, and dropped another anchor. When the full force of the hurricane struck two hours later, and the Catalina was in danger of being blown on to the reef and destroyed, he started both engines single-handed and taxied out to open water, where he could hold the aircraft with the engines. W/O. Hicks then remained at the controls for five hours, keeping the Catalina into wind, and away from rocks. The wind was blowing at over 50 m.p.h. with squalls exceeding 100 m.p.h.

This task, it is stated, would have taxed to the uttermost the skill and endurance of an experienced pilot, and W/O. Hicks was not a pilot but an engineer, with less than 350 hours' flying experience. The citation concludes: "It was an inspiring performance. By his resolute initiative, skill, and powers of endurance, he saved the flying boat from complete destruction, and in doing so, he might well have lost his life. He displayed outstanding courage and devotion to duty."

The Esher Trophy

AS announced in *Flight* of December 9th last year, competition has been revived for the Esher Trophy, which was awarded annually between 1926 and 1939 to the most efficient flying squadron of the Auxiliary Air Force, which has since received the prefix "Royal."

Further details are now available of Reserve Command's new regulations governing the award of the trophy. Because of wartime and post-war changes in squadron organization, the allotment of marks has been revised to allow for continued recognition of every aspect of squadron efficiency.

Marking is now divided into five parts, the first of which is for the number of flying hours logged annually by a squadron, in proportion to the number of aircraft on its charge. Part 2 is for pilot proficiency, while recruiting and attendance at annual camp are covered by Parts 3 and 4. The fifth factor to be assessed is discipline and general turnout, and marks awarded will depend on the impressions received by the A.O.C.-in-C. Reserve Command during his annual inspection.

Special attention will be paid each year to one item, such as pilots' logbooks or flight tool-kits, of which squadrons will be notified. Both pilots and ground crews thus share the spirit of competition fostered by the Trophy.

R.A.F. Permanent Commissions

GENERAL DUTIES BRANCH.

Squadron Leaders: A. R. de L. Innis, D.F.C., J. F. McPhie, J. M. Morgan, D.F.C.

Flight Lieutenants: R. A. E. Allen, J. G. Armstrong, T. H. Blackham, D.F.C., F. P. J. L. Danckwerdt, R. L. Dunkley, N. N. Ezekiel, D. G. Ford, R. G. E. P. Freeman, J. R. Gibbons, L. A. Green, D.F.C., R. A. Harvey, J. Higgins, R. B. Jackson, D.F.C., H. Mansell, A. J. P. Marvin, J. B. Miller, D.F.C., H. L. Pattinson, D.F.C., A. A. Pearce, W. W. Saunders, S. R. Sim, W. G. Smith, P. N. Speed, J. G. Taylor, R. C. P. Thomson, J. W. Valentine, E. J. Webb, H. T. H. Williams.

Flying Officers: C. C. Blount, V. H. A. Reeves.

TECHNICAL BRANCH.

Wing Commanders: J. A. Hickey, E. J. Praill, M.B.E.

Squadron Leaders: A. G. Boggis, R. G. Burnett, H. J. Gordon, S. W. Searle.

Flight Lieutenants: D. I. Catty, R. De Ste Croix, W. H. Hannaford, G. H. Miners, A. J. M. Morgan, R. S. Pearce, D.F.C., D. Perry, R. G. K. Smith, B. Trodd, J. E. Van Puyenbroek.

Flying Officers: P. P. Face, W. G. Warde.

EQUIPMENT BRANCH.

Flying Officers: A. M. Attard, D.F.M., S. J. Carr, B.E.M., R. D. Feek, A. L. F. Lloyd.

SECRETARIAL BRANCH.

Flight Lieutenants: G. W. Christie, M. G. Eliot, P. A. H. Moon, F. R. Passey, A.F.M.

BOB-SLEIGH PILOT: W/C. Cole, of an R.A.F. team at St. Moritz, fastens his crash helmet before making a run. Many members of the Service have been able to spend part of their normal leave at this resort through the R.A.F. Winter Sports Association.

Flying Officers: R. F. B. Blick, A. Bloor, P. R. Haskins, A. Scott, R. A. L. Simpson.
Pilot Officer: L. H. Cooper.

R.A.F. REGIMENT.

Flying Officer: W. D. Ratcliffe.
Pilot Officers: J. H. Bone, J. E. N. Molesworth.

AIRCRAFT CONTROL BRANCH.

Flight Lieutenants: W. H. A. Bradshaw, D.F.C., F. Jesson, R. Thompson, D.F.C.
Flying Officer: J. B. Fielding.

MARINE BRANCH.

Flight Lieutenant: J. W. Burke.
Flying Officer: J. M. D. Richards.

CHAPLAINS BRANCH.

Reverends: E. F. O'Doherty (R.C.), A. G. Prescott (R.C.).

PROVOST BRANCH.

Flight Lieutenant: C. F. G. Parsons.
Flying Officer: B. C. Player.

PHYSICAL FITNESS BRANCH.

Flight Lieutenant: J. N. Owen, D.F.C.
Flying Officer: D. M. Brown.

COMMONWEALTH OCCASION: Many distinguished visitors attended No. 24 (Commonwealth) Squadron's guest night at Bassingbourn. Among the guests were, left to right: (Back row) A. V-M. R. L. Ragg (S.A.S.O., Transport Command), G/C. H. R. A. Edwards (Station Commander), Air Marshal Sir Brian E. Baker (A.O.C.-in-C., Transport Command), W/C. P. A. Lombard (O.C. No. 24 Squadron), A. V-M. P. H. Mackworth (A.O.A. Transport Command), and in the front foreground, F/L. Sutherland, F/L. Gibbons and F/L. Cartwright.

Reunions

THE third post-war reunion of No. 230 Squadron will be held at Pimm's Red House Restaurant, 94, Bishopsgate, London, E.C.2, on April 23rd. Details from A. Dandeker, 16, Avondale Road, North Finchley, N.12.

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A reunion dinner for R.A.F. officers who served with Coastal Command units between December 3rd, 1939, and August 15th, 1945, will be held at the Connaught Rooms, Great Queen Street, London, W.C.2, on Saturday, May 15th. Applications for tickets (15s 6d) should be addressed to Officers' Reunion Dinner, H.Q. Coastal Command, R.A.F., Eastbury Park, Northwood, Middlesex.